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Contents

Editorials 401
- The Relation of Research to National Development
- Controlling Instruments Are Symbols of Modern Progress
- The Tendency Is to Annihilate Distance
- The Scope for Large and Small Industrial Enterprises
- Bromocyanide Treatment for Gold Ore
- Industrial Relations Improve, Except in Australia

Roan Antelope, in Rhodesia, May Deliver Eight-Cent Copper 404
By GEORGE L. WALKER

Extraction of Radium From Its Ores Presents Unusual Difficulties 406

Geologic Notes on the Santa Barbara Area in the Parral District of Chihuahua, Mexico 407
By HARRISON SCHMITT

"Politics" Overshadows Economics in Tin Market, Says Baliol Scott 411

Status of Domestic Magnesite Industry 411

The Noranda Enterprise—Part II 412
By A. H. HUBBELL

Why Development of Domestic Manganese Resources Should Be Fostered 430
By A. H. HUBBELL

Useful Operating Ideas	417	Personal Notes	433	Market Report	438
Comment and Criticism	419	Obituaries	433	Mining Stocks	440
By the Way	421	Market and Financial News	434	Technical and Industrial Service Directory	51
Consultation	421	Metal Price Curves	435	Searchlight Section	53-55
Industrial Progress	422	Review of Current Statistics	436	What and Where to Buy	56-58
Mining News	424	By H. L. JOHNSON		Advertising Index	60
Societies, Addresses, and Reports	429	*E. & M. J.* Statistics of the Mining Industry	437		
Recent Technical Publications	432				

Education Really Begins After Leaving College

HONORARY MEMBERSHIP in the A.I.M.E. was bestowed on Mr. John Hays Hammond at a recent meeting at Boston. In his speech of acceptance, Mr. Hammond reminisced in lighter vein, but much that he said is worthy of serious thought. After leaving Freiberg, young Hammond sought a job under George Hearst, of Homestake fame—to be turned down, because of his probable acquisition at college of "a lot of damn theories, and big names for little rocks." Only after Hammond's confession that he hadn't learnt "a blessed thing" at Freiberg did he get the job of helper at the Homestake assay office. In addition to reminiscences, much pertinent comment will be found in Mr. Hammond's talk, to be published soon. "Sophistry," he rightly maintains, "has no place in engineering. Engineers are not privileged to urge extenuating circumstances to explain their failures, but are held strictly responsible. The lawyer may ascribe the loss of his case to an incompetent judge or a corrupt jury. The doctor, the loss of his patient to the Will of God. The engineer cannot escape the odium of failures. He must make good."

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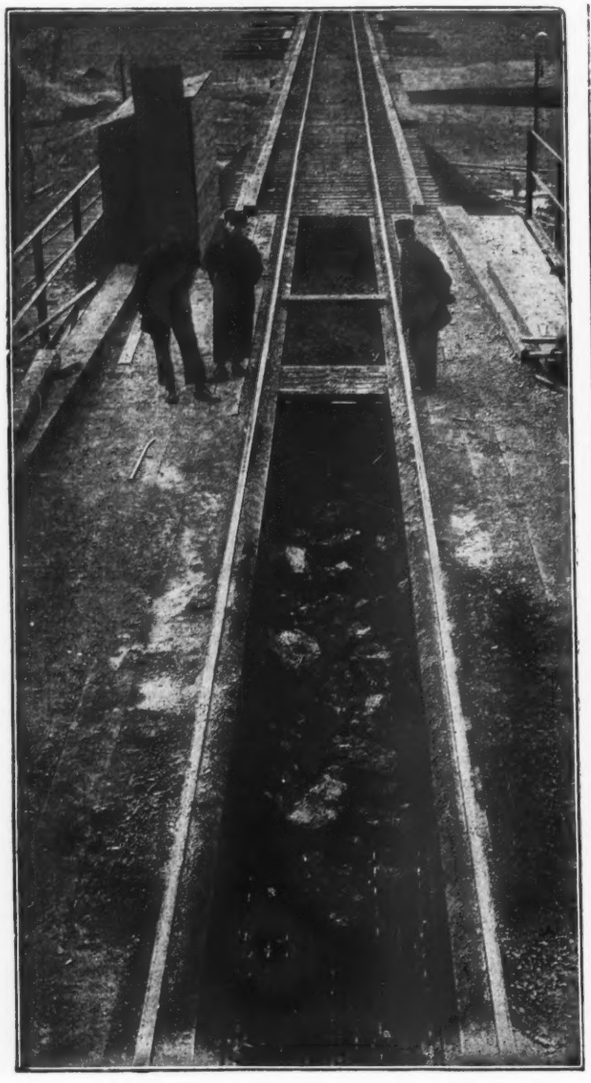

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ENGINEERING AND
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The Relation of Research to National Development

STATISTICS from each of many separate industries may be taken as indices of industrial activity of the country as a whole, including those referring to the manufacture of sulphuric acid. Recent figures, to appear in the forthcoming issue of *Mineral Industry* in an article by Professor Arthur E. Wells, are especially illuminating. The United States is now responsible for nearly half the sulphuric acid manufactured in the world. The output here doubled between 1913 and 1925, reaching the gigantic total of 6,300,000 long tons in the latter year. During the same period the output in Great Britain declined from 1,800,000 tons to 1,300,000 tons, and in Germany from 2,700,000 tons to 1,800,000 tons. The sulphuric acid industry is closely related to the industries responsible for the mining of sulphur and pyrite, in both of which a healthy activity is indicated. In 1903 the United States produced only 35,098 long tons of sulphur. In 1927 it *exported* 789,371 tons.

One outstanding factor was responsible for this amazing industrial development—individual initiative and invention, particularly in regard to the Frasch process, applied by the Union Sulphur Company in 1902, whereby superheated water and hot air are used to melt sulphur underground and so to permit its economical transport to the surface. The existence of sulphur in vast amounts in the United States had been known for many years prior to that time, but without the Frasch process it was as valueless as was the average low-grade metallic ore before the introduction of modern methods of handling and beneficiating.

Any proposal to curb research is fundamentally wrong, assuming, of course, that the proposed and necessary work is to be entrusted to the best men that can be found, with keen analytical and dissective minds, with experience, knowledge, perception, logic, and a capacity for unlimited perseverence. Any proposal that indirectly curbs research is also fundamentally wrong. It is usually unwise, if not reprehensible, to propose as an economic axiom that no development of a domestic resource is possible because the material can be imported cheaper from abroad than it can at present be produced at home. A neglect to develop domestic resources invariably involves neglect to carry on the research that might well lead to a repetition, with other essential materials, of the reversed position of the United States within the last quarter of a century in regard to sulphur—from that of importer to that of exporter in vast amount.

Frasch, mainly responsible for the sulphur industry of this country as it is today, was an individualistic inventor; and men of this type must be encouraged if national progress is to continue. A speaker at a recent meeting of the American Chemical Society deplored the waste occurring in research work and advised curtailment. The recommendation is pertinent and justified if considered as applying mainly to the employment of mediocrities, but it is not permissible to draw pessimistic conclusions from the number of mistakes made by inventors or research men. One of the most useless inventions ever brought to our attention was perpetrated by one of the greatest minds in the United States. It was a mistake—viewed from any angle. Leading authors have been responsible for some of the worst writing: We see only their masterpieces, and fail to appreciate the work that has been involved in an emergence from the sophomoric—the laborious steps in the attainment of full mental vigor and easy expression.

Errors and crudities may be used as stepping stones to success. A wise man may make a mistake, but it is only the fool who sticks to one. Mistakes are evidence of action, and that alone is indicative of something better than sitting on the fence with a smile of cynicism at the failures of others. To succeed in research and invention is to aim high—to think ahead of what others are thinking—to seek an ideal that others may consider impossible of achievement. Such a philosophy brings its failures and disappointments, it is true; but a proportionately richer reward should follow when success is achieved. A thousand problems of national importance await an attempt at solution, but relatively few workers possess a high type of mental inspiration and the physical zeal and perseverance needed to translate it into action.

Controlling Instruments Are Symbols of Modern Progress

INSTRUMENTS, so-called, have served to take the guesswork out of metallurgical and power-plant operation to a remarkable extent. In particular is this true of those designed for temperature recording and indicating. No justification exists for guesswork when a thermometer or pyrometer can be obtained for practically every purpose. To recite the applications found for these two devices alone in but a few of the smelters of the country would require a prohibitive amount of space. Where used in adequate number and variety they afford those in charge of operations a full knowledge of temperature conditions throughout the works.

Not all plants, indeed, are as well equipped as this would indicate. Some, in fact, are sadly deficient with respect to instruments. In them it is doubtful if operations are properly controlled, inasmuch as smooth, continuous work is scarcely possible without the aid of these accessories. Getting along without them in a power plant or smelter is like attempting to drive a tunnel without the

assistance of a transit. In either case the result is almost certain to be unsatisfactory.

In the shop, where cutting tools are tempered and the heat-treatment of steel in general is part of routine work, an opportunity exists for wider use of temperature-determining instruments. The eye is far too poor a judge of temperature to be relied upon. Despite this, the bulk of drill steel is sharpened and tempered without the aid of a pyrometer or equivalent instrument, though a more uniform grade of steel is undoubtedly obtained by its use.

Of the three classes of instruments referred to—recording, indicating, and automatic controlling—the recording type gives the greatest service. It works while the superintendent, and perhaps the attendant, sleeps, and it is ready at all times to give a not-to-be-disputed record of what has taken place. Such information at times is indispensable, especially when things go wrong. The indicating instrument, without the recording feature, serves only at the moment, but nevertheless aids in maintaining uniformity of operations. The automatic controlling type has thus far had a more limited application in the fields considered than have the others, though its use will probably be greatly widened in the future.

Among instruments other than those intended for determining temperature, the flow meter is of particular value. By it may be gaged the volume of air delivered to different mines, or the quantity of steam distributed to different departments of a plant, or the amount of water used in diluting pulp or fed into a boiler. Besides these instruments are the pressure, vacuum and draft gages—all of wide and varied application. And, finally, there is the carbon dioxide recorder, which has made it possible to obtain nearly perfect combustion of fuel in furnaces without the use of excess air, and the sulphur dioxide recorder, which is of service where an acid plant is operated in conjunction with a smelter.

The use of instruments for controlling technical operations is an index of a company's progressiveness. Such mechanical aids are indispensable for efficient operation and constitute a medium through which significant improvements can be made. Without them the present status of metallurgical art would not have reached the heights it has, and the records of achievement in the power-production field would have been less brilliant.

Instruments of precision are symbols of modern engineering progress.

The Tendency Is to Annihilate Distance

AN ADDITIONAL EXPENDITURE of over eleven million dollars for constructing new long-distance telephone facilities during 1928 has been announced by the American Telephone & Telegraph Company. This increase, made necessary by the rapid growth in the number of long-distance calls during the first half of this year, brings the total appropriations for new construction during 1928 on the longer telephone circuits of the Bell system to nearly fifty million dollars, compared with under thirty-seven million in 1927, the previous record year in construction.

These figures are impressive and instructive. The money will be applied to extensions and improvements on long-distance lines throughout the United States, as well as in speeding the preparation of short-wave transoceanic systems to supplement the long-wave transatlantic telephone system in service since January, 1927.

Other construction items included in this additional appropriation are aërial wire lines, telephone cable lines, carrier-current telephone and telegraph circuits, whereby several messages can be sent simultaneously over one pair of wires; telephone repeaters and loading coils that amplify the weakening voice currents on long-distance routes; radio program transmission circuits, and land buildings to house the special equipment needed to operate these lines.

Estimates at the beginning of 1928 called for 1,367 miles of new telephone cable construction—a record. This estimate is now further increased, and the completion of nearly 1,600 miles is planned by Dec. 31, 1928.

The people of the United States, among themselves, and the peoples of the world are thus being brought closer together. International communication by word of mouth is being recognized as an essential aid in the prompt and efficient conduct of business. The mining industries, in providing the most essential elements required for this gigantic construction program, are contributing to the annihilation of distance; and the progressiveness of the American Telephone & Telegraph Company is being reflected in the increased demand for non-ferrous metals.

The Scope for Large and Small Industrial Enterprises

THE ATTAINMENT of bigness, as we have said before, is not itself worthy of especial commendation. As connoting a co-ordination of interdependent activities and allied interests, whereby costs are reduced, sufficient financial stability is secured to resist successfully the periodic industrial depressions that would embarrass an impecunious operator, and to permit adequate attention to research in the application of science to industry—as such, bigness is to be welcomed for the good of the majority.

In a recent issue of the New York *Herald Tribune*, Mr. J. George Frederick, author of "Modern Industrial Consolidation," pictures the changed conditions surrounding group enterprise in the United States within the last twenty-five years, and the alteration in public sentiment toward industrial consolidation. When the Sherman Act was passed, a trust was the object of bitter condemnation. Now, the public eagerly buys stock in the immense industrial groups formed and forming, to benefit from the advantages of consolidation and diversification, scientific research, and adequate investment in modern equipment, and efficiency in marketing and sales. The business giants have changed, says Mr. Frederick, having become sensitive to public opinion and nervous of adverse criticism, which are desirable symptoms.

Nothing can stay an economic trend so pronounced as that which marks this major characteristic of modern American industrial life. Public opinion is no longer averse to mergers that result in better service and lower cost to the ultimate consumer; and outworn legislation is no longer effective in preventing all the benefits that accrue from amalgamations of a size that would have created apprehension twenty years ago. At the same time, the obvious benefits of bigness should not obscure the fact that progress has been due in no small measure to the moderately large business enterprise, of immense

aggregate importance to the commonwealth. Plenty of opportunity exists for the perpetuation of small and medium-sized ventures in avenues of service, usefulness, and profit beyond the reach of the larger corporations. In the conduct of its affairs, the small enterprise deserves a greater degree of consideration and more sympathetic treatment than does the bigger brother, and a place in the control of national policies in proportion to the confidence it has earned in the past. Big business will always suffer from lack of easy contact between itself and the public, which leads to a lack of sympathy and understanding. The smaller concern can strike a personal note in its relations with the buyer, and thus it is possible for it to earn confidence the easier.

Bromocyanide Treatment for Gold Ore

WESTERN AUSTRALIA is turning attention to refinements in the application of the Sulman-Teed bromocyanide invention, whereby the roasting of a sulphotelluride gold ore is unnecessary. Mr. C. E. Blackett, well known for his work when metallurgist of Golden Horseshoe Estates, has been conducting a research, according to an account in our London contemporary, *The Mining Magazine*. The need for precise chemical control has been demonstrated, and experiments have shown that a high extraction of the gold is obtainable by a treatment comprising separate agitation with cyanide and bromocyanide solutions, and in the order stated. A two-hour agitation with cyanide and a one-hour agitation with bromocyanide has been found to give maximum results on one ore, three hours with cyanide and two hours with bromocyanide being the best combination on another.

This change in the character of the solvent, incidentally, is in line with the conclusion that residue gold may be, in some instances at least, adsorbed gold, especially if excessively fine grinding has been practiced. A change in the physical character of the solution may alter surface-tension influences to an extent permitting the release of gold held thus. Picric acid adsorbed on platinum black from an aqueous solution is insoluble in water, but is immediately released if alcohol be added to the water. Similarly, it is not always effective to continue the treatment of an ore with the same solution or the same wash, even in intermittent steps, if the ore has been ground so finely that adsorption effects have played an important part in the retention of the gold on the surfaces of the gangue particles.

This is straying from the subject, however. The essential value in Mr. Blackett's work lies in the conclusion that ample opportunity exists for further research, even in connection with an invention that may have been developed a great many years ago, and forgotten by most metallurgists. The field for extended use of a halogen as an activator in a solvent for gold has not been adequately explored. With the significant changes made in recent years in the more efficient and more economical production of bromine—particularly in regard to its extraction from the salt-plant bitterns in the San Francisco Bay region—it might be advisable again to study the scope for the use of a double salt such as bromocyanide in the treatment of a moderately as well as a highly refractory gold ore.

Industrial Relations Improve, Except in Australia

LOCAL disputes between employer and employee are the basic causes of general industrial unrest, business disorganization, decreased output, and poverty. It is interesting to note, as statistics prove, that many of the principal nations of the world are entering a new era in this respect; an exception is Australia, where economic conditions for many years have been adversely affected and progress has been retarded by a labor movement lacking evidence of a spirit of a larger idealism than that which seeks reform to benefit but a section of the community. The following ratios of workers involved in strikes and lockouts in 1927, per 1,000 of population, as against a corresponding number in earlier years, prepared by the National Industrial Conference Board, is illuminating: United States—3, as against 40 in 1919; Great Britain—2, as against 63 in 1919; France—2, as against 37 in 1920; Germany—6, as against 135 in 1920; Belgium—5, as against 40 in 1920; Netherlands—2, as against 10 in 1920; Canada—2, as against 16 in 1919; Australia—25, as against 19 in 1919-20. In 1927, Australia achieved an unenviable record, with the highest number of workers involved in industrial disputes that had ever been recorded.

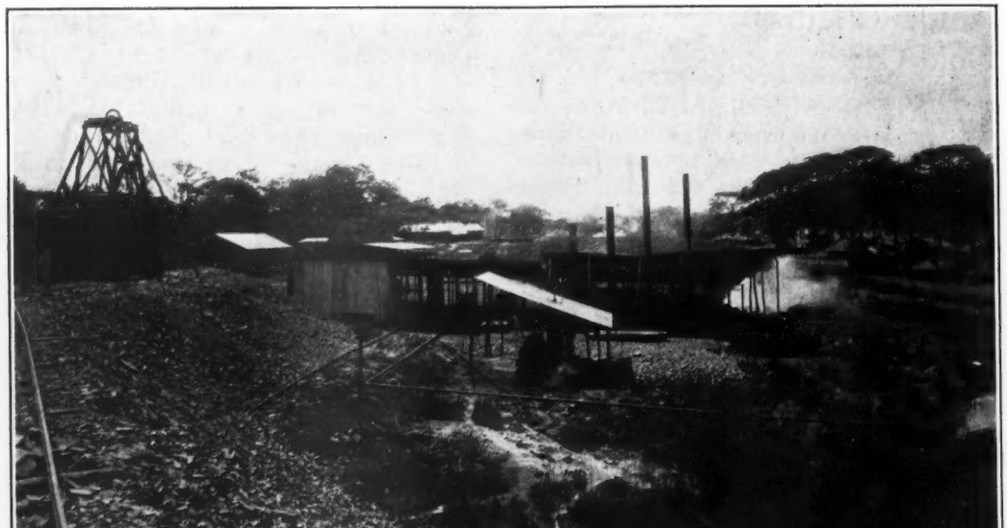
Mining in Australia cannot be expected to revive until an improvement in industrial relations is effected, following a readjustment of opinions and conditions and a realization of the grave danger in delaying consideration of this important factor in the life of a nation. A contempt for opposite opinion always makes adjustment of differences an exceedingly difficult matter; and in this respect both sides have been to blame, with an apparent lack of appreciation of the success of contemporary methods of alleviation and conciliation as a contributing cause.

Workers are not unreasonable in demanding fair pay and short hours of labor; but employers are equally within their rights in an insistence on quality and quantity output—on care and zeal. Loyalty must be forthcoming from both sides. The interests and aims of employer and employee are interdependent and complementary. The single aim of industrial effort as a whole—national prosperity—should be recognized, and the deep-seated spirt of antagonism between labor and capital must be overcome, even if it be necessary to enable every laborer to become a capitalist. Until each party realizes that the future of the country depends on the development of a truly co-operative spirit, in bargaining as between equals, as between the complementary parts of an industrial fabric, no progress will be made.

Internal prosperity is based largely on domestic buying power, which is reduced to a minimum during strikes and lockouts. Settlement means the end of a deplorable condition—not a victory for either side; and this must be realized to the full. When settlement is reached by virtue of the collapse of one of the parties, the situation is full of hazard for the future, calling for the exercise of consideration and even generosity. Australia, a land where opportunity is cramped by the frequency of industrial disputes, possesses distinguished technicians and engineers, capable craftsman, and vast national resources. Its early emergence from the present state of uncertainty is a necessary preliminary to greater prosperity in the Antipodes.

Roan Antelope, in Rhodesia, May Deliver Eight-Cent Copper

By GEORGE L. WALKER
London, England



One of the development shafts at the Roan Antelope property

ROAN ANTELOPE Copper Mines, Ltd., in which Americans have considerable financial interest, is the owner of one of three particularly interesting deposits of copper ore in Northern Rhodesia. They are all of the same general type, and I understand that two more, which seem to be similar, have been found. A fourth is the one from which Bwana M'Kubwa is producing but it is geologically different.

The accompanying outline map and cross-sections of the Roan Antelope deposit make it clear that the ore—disseminated chalcocite in a bed of feldspathic shale—has the form of a long synclinal trough and that the apices are from 1,500 to 2,100 ft. apart. At the point shown in the drawing the bottom of the ore is about 700 ft. below the surface, but further northwest it appears to reach a depth of 1,700 ft.

The following estimates of ore developed are understood to include something less than the total indicated tonnage in the area beginning at the southeast end and extending northwest for a distance of 10,000 ft. Dr. Otto Sussman, of the American Metal Company, estimated "30 million tons of sulphide ore averaging 3.4 per cent copper," and William Selkirk wrote in his report: "I am of the opinion that the quantity of ore proved to date is about 40,000,000 tons of sulphide ore averaging over 3.25 per cent copper. . . . I confidently expect an additional 20,000,000 tons as a minimum."

A hole drilled at a point 6,000 ft. further on—that is, 16,000 ft. northwest from the southeast end of the deposit and 6,000 ft. beyond any previous drill-hole—recently has disclosed what is undoubtedly the continuing extension of the deposit, the formation, character, and grade of ore being similar. The total length of the deposit still remains to be determined.

I am told that every hole put down between the two apices of the deposit has cut ore of good width and in all occurrences of much the same grade. The Roan Antelope assay maps show a uniformity of copper content that almost approaches the monotonous. There is little secondary enrichment below the belt of oxidation. In the sulphide zone almost the same copper content is found in every crosscut and drill hole. The following table shows a typical crosscut assay record, hanging-wall to footwall:

Widths Inches	Copper Content Per Cent	Widths Inches	Copper Content Per Cent
30	1.9	60	4.0
60	3.8	96	3.8
60	3.9	60	3.5
60	3.9	60	2.2
60	4.4		

The average copper content noted in the foregoing tabulation is 3.6 per cent; the dip of the ore at this point is 50 deg. and its true width here is 34.7 ft. Dr. Sussman gives the width of the ore as "10 ft. (true thickness) to 47 ft." Variation of thickness is a feature both of the N'Kana and N'Changa deposits also, and in those two other Northern Rhodesia orebodies blank holes are likewise almost unknown, the only exceptions to this rule being when holes are placed so as to cut the leached area that is occasionally encountered close to the outcrop.

This remarkable uniformity of mineralization, with a total absence of those alternating shoots and belts of richness and poverty that usually feature copper deposits, has caused new theories of the genesis of the ore to be advanced. One of these is that the copper was introduced by cold meteoric waters simultaneously with the deposition of the shale-forming sediments, being derived from the denudation and leaching of older ore deposits situated in the then-existing land mass that furnished the sediments. Notwithstanding the presence in the ore of small amounts of chalcopyrite and bornite, the theory here outlined seems to deserve more than casual consideration. Vast amounts of copper must have been released by erosion during past ages, and it is not improbable that some of it will be found in the sedimentaries. Many engineers who have examined the deposit think the copper was introduced at the time of the later granitic intrusions. The mineralization is being subjected to a careful scientific study.

It very naturally will be assumed off-hand that these new deposits of copper ore in Northern Rhodesia are like the so-called American "porphyries." But are they? They are almost wholly chalcocite, this mineral having changed at the shallower depths to carbonates, with some silicates and oxides; and the impurities seem to consist almost wholly of the rock gangue and a small amount of silver. The American porphyries in many instances have a rather important content of chalcopyrite and other copper minerals also, and as they usually have a considerable amount of iron and sometimes other impurities which must be eliminated, they hardly can be said to resemble the Northern Rhodesia ore deposits metallurgically. They certainly do not from the geological standpoint.

Except mineralogically, these Rhodesian deposits can most readily be likened to those of the Lake Superior district. They are beds or lodes. Flotation will be used as a method of concentration. Aside from the elimination of the sulphur, smelting and fire refining will be much the same in Rhodesia as at Hubbell, Houghton, and Hancock, Mich. If fire refining can be developed to a comparable stage of perfection, the Rhodesian product will become much like Lake copper, similarly having a few ounces of silver per ton.

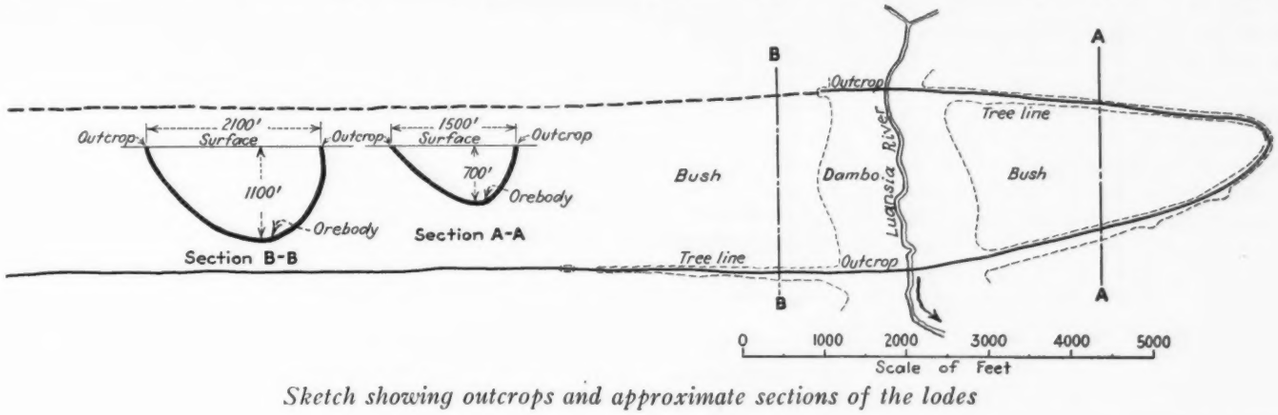
It is interesting to compare the Roan Antelope ore deposit with the Calumet conglomerate lode. The former has about one-third the depth (depth here being from one apex down the syncline and up to the other), it is nearly 2¼ times as wide, apparently half again as long, and the percentage of copper contained is much the same. This comparison might be carried further, but I shall leave it to those sufficiently interested to do it themselves.

The Rhodesian deposits are not like those at Katanga, a short distance north. At Katanga the ore is chiefly in relatively superficial deposits that occur in most formations as replacements of dolomite. As a rule the Katanga orebodies are on the tops of hills or ridges; they carry their copper almost wholly in carbonates and oxides, and as is well known are remarkably high in grade, as the result of secondary enrichment. In a different rock, though not impossibly in the same geological stratum, the Rhodesian ores are found in comparatively level country, are much more deeply seated, in some instances (like the one being considered) are of enormous tonnage, and below the superficial zone of oxidation become sulphides.

Coal and other mining, milling, and smelting supplies will generally cost more in Northern Rhodesia than most American producing companies pay, the difference being measured by the higher transportation charges, particularly by land. Freight rates, however, are certain to be reduced gradually. In the matter of repairs, when machines break down the Rhodesian companies will have an advantage over those in South America in earlier times, as there are already extensive mining, milling, and smelting activities with large machine shops to the south and north of them.

Dr. Sussman, in arriving at a total cost of 8.15c. per pound copper delivered in Europe, appears to have allowed 2.35c. for transportation charges. I think he included in this the small royalty to be paid to the British South Africa Company, and also the selling commission, as the freight rate, including harbor charges and insurance, amounts to 1.90c. As the freight rate on copper from Rocky Mountain points to the Atlantic seaboard is 0.625c. per pound, the difference in favor of American producers in this respect is 1.275c. per pound, and on the American copper shipped to Europe, 1.025c.

The greatest advantage of the copper producers in Northern Rhodesia will be in the superior richness of the



Sketch showing outcrops and approximate sections of the lodes

ore. Roan Antelope will recover 1,000,000 lb. of copper from each 18,200 tons of ore that it treats, whereas the same production results from handling 28,000 tons from the richest and 66,000 tons from the poorest of the American porphyries. The capital investment —the capital to be written off as a charge to production costs—and other things also will be in ratio with the tonnage figures given.

Other advantages are evident. Roan Antelope's construction and general-housing expenditures will be made smaller by the warmth of the climate, and by the simple requirements of its native employees. Wages will be low, but the labor cost need not necessarily be lower than that of American mining companies. An abundant supply of water for milling purposes is available adjacent to the mine, and although coal and steam power will be employed at first, hydro-electric energy undoubtedly will be generated later.

One feature of the Roan Antelope undertaking calls for particular consideration. If present calculation prove accurate, approximately 100,000,000 lb. of annual copper productive capacity will be created by a total capital expenditure of $15,000,000, which is only 15c. per pound. Such productive capacity is variously valued on the New York Stock Exchange all the way from 55c. up to 90c. per pound, and that recently created by the Andes Copper Company apparently cost 26.66c. Thus each dollar invested will receive the final net profit arising from the annual production of 6.66 lb. of copper in the productive operations of Roan Antelope. In view of this it is apparent that copper productive capacity will continue to be created in Africa as long as ore deposits at all comparable to that of Roan Antelope are available. American investment in Northern Rhodesia copper mining seems, for the same reason, likely to be largely increased.

Extraction of Radium From Its Ores Presents Unusual Difficulties

DIFFICULTIES not ordinarily encountered in metallurgy are confronted when one seeks to extract radium from its ores, such as carnotite, according to J. P. Bonardi, whose biography was recently published in *E.&M.J.* Radium content of the average carnotite ore is approximately equivalent to one part in two hundred millions of ore. When it is realized that 90 per cent recovery is actually made, the magnitude of the difficulty will be appreciated.

Inasmuch as approximately 200 tons of average ore is required to produce one gram of radium, concentration of the highest degree and requiring careful plant control at every stage is necessary. In brief, the method carried out by the U. S. Bureau of Mines in co-operation with the National Radium Institute was as follows:

The ore was ground to 20 mesh, leached with hot nitric acid, filtered, neutralized carefully with sodium hydroxide, a solution of barium chloride added (about 2 lb. per ton of ore), followed by sulphuric acid, and a precipitate of radium-barium sulphate obtained. The filtrate from this separation contained the uranium and vanadium, which were subsequently separated as sodium uranate (finally converted to U_3O_8) and iron vanadate. The crude radium-barium sulphates were next reduced with carbon to sulphide, treated with hydrochloric acid and put through a series of fractional crystallizations, first as chlorides, then finished as bromides and sealed in glass tubes, ready for delivery.

The many crystallizing steps involved in arriving at the final product, containing about 50 per cent radium in the form of bromide, can be imagined when it is understood that the original crude sulphates contain approximately one part radium in one million parts of mixed sulphates.

In the fractional crystallization of the chlorides each succeeding step increases the radium content in the crystals obtained. The crystallization factor is about 1.5, that is to say, if 50 per cent of the barium chloride is removed in the mother liquor there will be 50 per cent more radium in the crystals produced than in the liquor left behind. The radium continues to be enriched in the crystal fractions and impoverished in the successive mother liquors. Crystals are carried forward in one direction while the mother liquors go in the opposite direction. Barium chloride, being more soluble, is eliminated.

A fair acid concentration was maintained throughout the series. Starting with a chloride solution containing one part radium per million as given for the crude sulphate, the chloride crystallization was carried out at the plant of the National Radium Institute (no longer in existence), in Denver, in large vessels and later in the laboratory in smaller vessels until the radium content had reached around 50 parts per million, after which the chloride crystals were converted to bromides. The advantage of converting to bromides is attributable to the difference in the crystallization factor of the salts, this being about 2. That is, if one-half of the salt is crystallized from a given fraction, two-thirds of the radium is contained in the crystals and one-third in the mother liquor. The bromide crystallization is carried out until about 1 to 3 per cent radium-bromide salt is obtained, then dried, pulverized, and sealed in small glass tubes. After accumulating several such tubes, these are opened up, combined, and finally "stepped up" to a concentration of around 50 per cent radium element ready for delivery. About 25 days of steady operation are required to reach this stage, beginning with the crude sulphate. Great care must be taken throughout the work to keep all solutions freed of interfering elements and that proper concentration of either hydrochloric or hydrobromic acid is maintained at all times. Distilled water must be used for all solution purposes.

Radium being a disintegrating product of uranium, the amount of it present in unaltered ores is always in fixed proportions to the amount of the uranium element present. That is, one gram of uranium is in radioactive equilibrium with 3.4×10^{-7} grams of radium. Therefore the percentage of uranium is an index of the milligrams of radium present. Approximately 3 million parts of uranium element are equivalent to one part radium.

During the operation of the National Radium Institute and also during the war the market price of radium was around $120,000 per gram of element, depending upon the grade. Now it can be obtained for around one-half this price, owing to the high-grade ores being treated from the Belgian Congo. No American concerns are now producing it from American carnotite ores.

Geologic Notes on the Santa Barbara Area in the Parral District of Chihuahua, Mexico

By Harrison Schmitt
Mining Geologist, Hanover, N. M.

THE Santa Barbara section of the Parral mining district, in southern Chihuahua, is noteworthy for unusual geological features, especially the remarkable strength and persistence of the veins and the variety of minerals contained in them. Since 1923 I have had several opportunities to make geological studies there, the total time spent aggregating about eight months. Such field work as I was able to do was supplemented by laboratory studies at the University of Minnesota. This paper is part of a thesis submitted there on the ore deposits of the Parral district.

The Santa Barbara area includes a group of mines situated about 12 miles southwest of Parral. Although worked since 1547, these mines are still important. Gold was the only metal produced in the early days, but now lead and silver are the chief metals, with copper and zinc as valuable supplementary products.

The principal publications on this area are as follows: Weed, W. H.: "Notes on Certain Mines in the states of Chihuahua, Sinaloa, and Sonora, Mexico," *Trans.* A.I.M.E., Vol. 32, 1902, pp. 399-402; Dominguez, Norberto: "The District of Hidalgo del Parral, Mexico, in 1820," *Trans.* A.I.M.E., Vol. 32, 1902, p. 459; Rice, C. T.: "The Silver-Lead Mines of Santa Barbara, Mexico," *Engineering and Mining Journal,* Vol. 86, pp. 207-211 (1908); and Spurr, J. E.: "The Ore Magmas," Vol. 2, 1923, pp. 669-674.

Much field work on this area was done in 1922 by John G. Barry, of El Paso, Tex., although none of the data collected by him have been published. Through his courtesy Fig. 1 is reproduced. I am indebted to the American Smelting & Refining Company for permission to publish the data collected from its property. Valuable aid and criticism have been afforded me by Dr. W. H. Emmons and Dr. F. F. Grout, of the University of Minnesota, and by Augustus Locke, of San Francisco.

Topography Steep but Not Precipitous

The topography of the district is that of late youth—that is, interstream plateau areas predominate over those of slopes. The streams flow in V-shaped valleys that dissect a basalt-covered erosion surface. The valley slopes, although steep, are precipitous only where arroyos cross rhyolite dikes, veins, or areas that are strongly silicified.

Differential erosion has given bold outcrops, which "hold up" many of the ridges. The average elevation of the area is about 6,900 ft. above sea level, and the relief is about 480 ft. Average annual precipitation is between 20 and 30 in.

The areal distribution of the rocks in the most important part of the region is shown by Fig. 1. Most of the country rock is classed as calcareous shale, but some of it is a hard, blue-black shaly limestone. These rocks are strongly folded and faulted and are probably Pre-Comanchean in age.

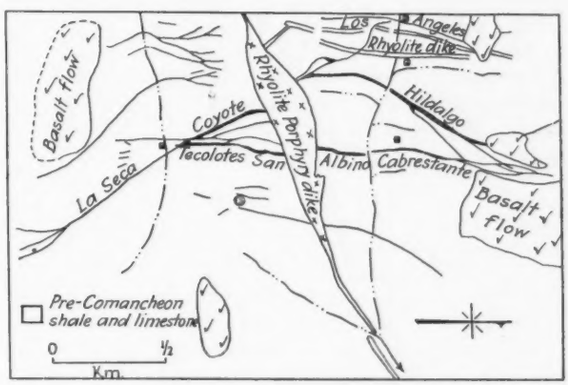


Fig. 1—Geologic plan of the most important part of the Santa Barbara area

Hard, light-colored rhyolite-porphyry dikes cut the country rock. These dikes in thin section usually show phenocrysts of quartz and orthoclase in a fine-grained matrix. Some of the narrower of the dikes, however, have no phenocrysts and show conspicuous flow structure parallel to their walls. In thin section the flow lines are made evident by quartz finer grained than that in the rest of the field, and by streaks of kaolin that presumably resulted from the alteration of feldspar. Rounded areas, almost isotropic, appear to have been spherulites formed in a glassy matrix that has become devitrified.

Rhyolite Cut by Dikes

Cutting and overlying the rhyolite and the sediments are dikes and flows of olivine-basalt. The flows appear to have inundated the topography in recent time. In this section the topmost flow shows corroded and slightly serpentinized olivine phenocrysts making up about 10 per cent of the field. There are idiomorphic phenocrysts of plagioclase, near labradorite in composition. The matrix is composed of microlites of plagioclase, pyroxene, magnetite, and olivine. Calcite makes up about

1 per cent of the field and appears to have *displaced* the matrix rather than to have *replaced* it. Idiomorphic phenocrysts of wholly unaltered feldspar are inclosed by this carbonate. This suggests that the magma, in passing through limestone on its way upward, absorbed some calcium carbonate.

The basalt flows were evidently fissure eruptions, because they are related to local basalt dikes. Conditions indicate that a new cycle of differentiation may be starting in the region, the very acid rhyolites being taken as the climax of the previous cycle in the early part of which more basic rocks were present. Between the rhyolite and basalt epochs was a marked period of erosion.

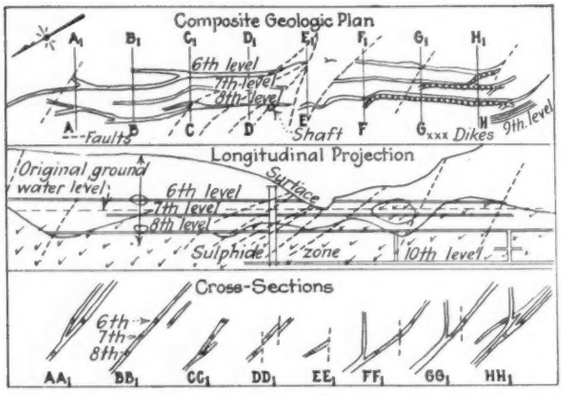


Fig. 2 — Composite geologic plan, longitudinal vertical projection, and cross-sections of the Hidalgo mine showing the structure of the veins and dikes, the original water level and the depth of oxidation

A discussion of the structure of the area narrows down to the consideration of the forms and relations of the faults, veins, and dikes only, because the pre-mineral folds of the country rock were too complex to make their study practicable. Most of the veins are along faults of unusual regularity of dip and strike. Study of striations on the walls and flexures of the bedding of the wall rock indicates that these faults are of the normal type. Fractures in the footwalls and hanging walls have attitudes that tend further to verify this.[1] Occasionally one of the larger hanging or footwall fractures is mineralized and makes a commercially important vein, occurring as a branch of the main vein.

Post-mineral faults are found cutting the veins and dikes, although few of them show offsets of more than 60 ft. These faults seem to be of three types and ages, and they are classified as follows:

1. Quartz-filled faults (near valuable mineralization age).
2. Calcite-filled faults (late barren mineralization age).
3. Gouge-filled faults (recent age).

Some of these faults, dipping almost vertically, have their major component of movement horizontal, taking, therefore, the nature of thrust faults.

The several veins have dips varying from 40 to 90 deg. Well-defined walls and great regularity of dip and strike are their prominent structural features. Branch veins diverge from the main veins along the strike, especially when the latter are about to play out horizontally.

The late rhyolite dikes have interesting relations to some of the veins. One of these dikes, which intruded in and is parallel to the Hidalgo vein, has in places split the vein in two parts, making mining more difficult and locally unprofitable. After the intrusion, furthermore, quartz was introduced along the dike-ore contacts, reducing the grade of the ore and in spots making it unprofitable.

Relatively shallow depth of intrusion is indicated by the structure of the dikes. Thus the cross-section of the Hidalgo dike, Fig. 2, suggests that the intruding rhyolite magma found the easiest path, in depth, to be along the vein, but that nearer the surface the path of least resistance was directly upward through the hanging wall. Furthermore, the large rhyolite dike that cuts the San Albino and other veins of the camp (see Fig. 1) widens rapidly upward.

Oreshoots are hard to delimit in most of the veins, because the ore occurs as tabular bodies of considerable vertical and horizontal extent. The strike length of a shoot may be as much as 950 ft. and the dip length more than 650 ft. Locally richer and wider parts of the veins can be recognized, such enriched parts often occurring at vein junctions. This habit is shown by the composite plan of the Hidalgo mine, Fig. 2.

The depth of origin of the ore now developed was perhaps about 3,000 to 4,000 ft. After studying the depth of origin of the ore deposits, in the Parral section which are presumably the same age as those of Santa Barbara, it was estimated that about 3,000 ft. of volcanic material covered the sedimentary rocks at the time of mineralization. At Santa Barbara all the volcanics have been removed, and the basement of sediments has been eroded to a depth of several hundred feet.

Three distinct kinds of primary ore are mined at Santa Barbara. One is a siliceous lead-silver-zinc type, characterized by massive galena and sphalerite and containing minor amounts of chalcopyrite and pyrite. A second is very siliceous gold-silver ore, distinguished by the absence of massive sulphides and the presence of silicate minerals such as pyroxene and garnet. A third variety, like the first, carries much massive sulphide, but in addition a large amount of silicate minerals. Typical assays of these ores are as follows:

	I	II	III
Lead, per cent	10.0	1.5	15.0
Zinc, per cent	6.7	1.5	10.0
Copper, per cent	1.5	0.3	2.0
Gold, grams per metric ton	1.3	6.0	3.0
Silver, grams per metric ton	250.0	300.0	250.0

I. *The massive sulphide ore*—This type of ore is found in the Hidalgo, Los Angeles, Coyote, Cabrestante, and Tecolotes veins. Primary minerals so far identified are as follows:

Ore	Gangue
Galena	Quartz
Sphalerite	Fluorite
Chalcopyrite	Garnet (locally)
Argentite (?)	Specularite (locally)
Pyrite (small amount)	
Arsenopyrite	

An attempt was made to work out the paragenetic relations of the foregoing minerals by a study of thin and polished sections. The result is shown graphically by Fig. 3-A. Several features should be noted:

1. A large part of the quartz was precipitated as coarse crystals before the sulphides, but some persisted through to the last.
2. The fluorite is always associated with the sulphides and appears to be contemporaneous with them.
3. Galena and sphalerite are always closely associated and were deposited over about the same period of time.

[1] Willis, Bailey: "Geologic Structures"; Chap. VII, 1923.

Galena occasionally appears definitely later than the sphalerite, because it cuts the latter mineral as veinlets, but in some occurrences sphalerite seems later. Such relations should be expected if mineralizing solutions carried both these minerals at the same time.

4. The chalcopyrite, occurring in the sphalerite as the usual microscopic blebs, is considered the same age as the latter mineral. The chalcopyrite, cutting all minerals as veinlets, obviously is late.

II. *The siliceous gold-silver ore containing abundant silicate minerals*—Most of the ore of this type is found in the San Albino vein. Primary minerals identified are:

Ore	Gangue
Galena	Quartz
Sphalerite	Fluorite
Chalcopyrite	Herderite (?)
Argentite	Pyroxene (clino-enstatite)
	Garnet (isotropic)
	Garnet (birefringent)
	Epidote
	Zoisite
	Calcite

The paragenetic relations of the foregoing minerals are shown graphically on Fig. 3-B. Features are:

1. Quartz was deposited over the entire mineralization period, but most of it was distinctly early, as in most of the other ores of this camp and of the entire Parral district.

2. Some of the silicate minerals are later than the sulphides and fluorite.

3. The sulphides, although scanty, are closely associated with the fluorite. The absence of abundant sulphides may be accounted for by the probability that the fluorite-sulphide stage occurred at a higher temperature than the corresponding stage of the ore of type I.

The mineralization of the San Albino vein grades into the massive sulphide mineralization toward the north, where the same vein is called the Cabrestante. Toward the south it grades into the Coyote and Tecolotes veins, which carry massive sulphide ore mainly. Thus there appears to be a zoning of these two mineralizations, the San Albino type being a "hot centre" around which is found the lower-temperature, massive, sulphide ore.

III. *The massive sulphide ore with abundant silicate minerals*—The bulk of this ore has been found in the Alfareña vein, which lies about a mile east of, and more or less parallel to, the San Albino vein. It is outside the area shown in Fig. 1. Primary minerals so far identified are:

Ore	Gangue
Galena	Quartz
Sphalerite	Fluorite
Chalcopyrite	Pyroxene (clino-enstatite)
Pyrite	Orthoclase
Stibnite (?)	Herderite (?)
Arsenopyrite	Epidote
	Calcite
	Garnet (birefringent)
	Vesuvianite (?)

The paragenetic relations of the minerals listed in the table immediately above are shown graphically on Fig. 3-C. A number of features of this mineralization are worthy of note:

1. Orthoclase (not adularia) is present as a vein mineral.

2. An early silicate stage of mineralization was followed by a period of shattering, after which sulphides were deposited. The early stage is represented by a mineral aggregate of quartz, orthoclase, fluorite, and pyroxene that is suggestive of a pegmatite but that has the grain of an aplite. Note that here the fluorite is pre-sulphide.

3. A stage later than the sulphides is represented by calcite, epidote, and zoisite.

4. As in the other ores, much quartz is early, and some continues to the last.

5. Garnet and vesuvianite (?) replace the pyroxene, suggesting conditions changed during the silicate or high-temperature stage.

The time relations of the three types of ore described are not obvious. According to Barry, in the Tecolotes mine, in some places the high-temperature or silicate-stage cuts the solid-sulphide or lower-temperature mineralization, but in the Alfareña mine, the mineralization of which was just described, the reverse relation is the rule. Thus the following succession of mineral stages is suggested.

1. A solid-sulphide, moderate-temperature period.

2. A stage characterized by silicate minerals of high-temperature origin.

3. A solid-sulphide stage.

4. A period when calcite, epidote, and zoisite were deposited.

This order suggests that during mineralization temperatures rose and declined.

Secondary (Supergene) Ores

Oxidation extends to a depth of about 325 ft. This is also about the average depth to the ground-water surface. Until recently the oxidized ores were of great importance. In the early days extremely high-grade gold ore was mined near the outcrop. Norberto Dominguez says that some of it carried 80 oz. per metric ton.

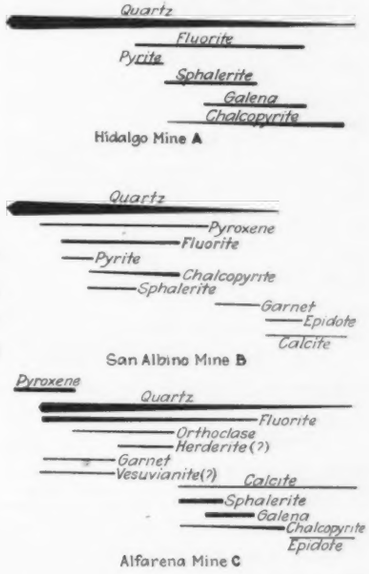


Fig. 3—Mineral paragenesis of the Hidalgo, San Albino, and Alfarena mines at Santa Barbara

I have seen assays of samples cut in certain old stopes that ran 8.5 oz., although on the average they are much lower. In the oxidized ore now mined lead and silver are the chief metals.

There is a little gold, but zinc and copper have been almost completely leached out.

The minerals of the oxidized zone were studied with particular care in the Hidalgo mine, and the following is a list of the principal ones identified, with notes on their occurrence:

Cerussite—This is the most abundant and important secondary ore mineral. It was noted in two distinct forms: the tabular and the bi-pyramidal. It is usually white or grayish, although some has a bluish or greenish

color as a result of copper staining. Some of this mineral appears to have been derived directly from galena, some from anglesite.

Anglesite—This occurs in small quantities as the characteristic concentric, amorphus, gray shells around galena.

Plumbojarosite—Much of this was identified and is an ore mineral in this mine. It is the characteristic yellow micaceous material and shows platy hexagonal crystals microscopically. Some of it occurs incrusted on cerussite, and so is later than that mineral.

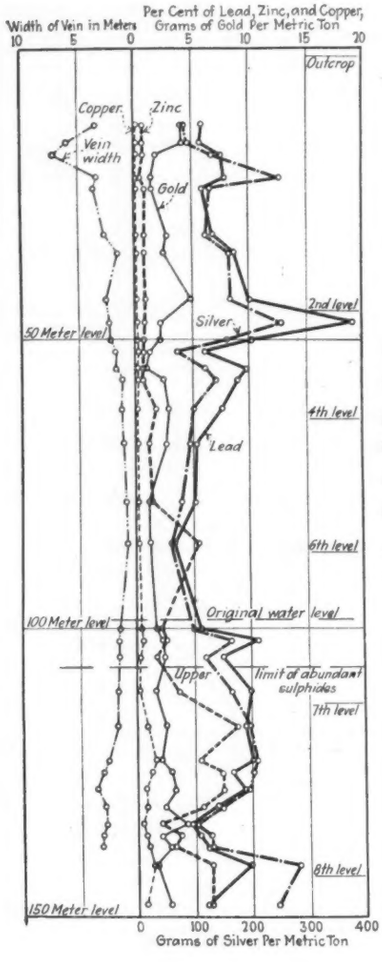


Fig. 4 — Assay-value curves based on sample data taken from a mine in the Santa Barbara camp. The variation in metal content from the outcrop to the lowest level is shown.

Mimetite—This mineral is present at many places in small amounts, appearing as yellow crystals or crusts. Many of the crystals are shaped like minute doughnuts. Where the relations can be made out, the mimetite is later than cerussite. Mimetite is an ore mineral in the neighboring La Paz mine. The arsenic was there derived from primary arsenopyrite.

Pyromorphite—This mineral occurs as yellow and brown crusts, and as small white hexagonal forms capped by pyramids. The hexagonal faces of these latter crystals have striations normal to their long edges. Thus they look exactly like small quartz crystals and were thought to be such until their hardness was tested. The pyromorphite is generally later than the cerussite.

Hisingerite—This mineral was found associated with jarosite. It gave characteristic optical and chemical tests.

Jarosite—Some jarosite occurs as a yellowish, powdery material containing a little lead.

Calamine—In one stope near the ground-water surface much calamine occurs as radiating sheaf-like groups of tabular and prismatic white crystals that lie in cavities that represent space formerly filled with sphalerite.

Malachite and Azurite—These minerals are abundant locally near the ground-water surface.

Plattnerite—This rare mineral occurs as small black globular masses in cavities associated with calamine. It was identified in a specimen taken only a few feet above the ground-water surface.

Smithsonite—Some smithsonite exists locally as white and green crusts. It is usually near the ground-water surface.

Bornite and Chalcocite—These minerals are common but not abundant. They occur near the ground-water surface. The microscope shows that they resulted from the replacement of chalcopyrite along fractures, and this relation, of course, indicates a slight enrichment of copper.

Metal Content of Ores at Various Depths

By means of assay records of the Hidalgo mine, curves were compiled that show the variation of metal content from the outcrop to the lowest workings. Fig. 4 shows these curves, and Fig. 2 the location of the vertical section of the 212 samples used as a basis. The following points may be of interest:

1. Copper and zinc are almost completely leached out above the ground-water surface. This leaching does not progress below a certain minimum value, which appears to be about 0.5 per cent for zinc and 0.1 per cent for copper.

2. Enrichment of copper is suggested by the curve for copper, which shows an increase below the ground-water surface. Microscopic data of polished sections, obtained from a point just below the ground-water surface in the area used for the curves, shows the development of bornite and chalcocite from chalcopyrite.

3. The gold content, 1 to 5 grams, although locally irregular, averages about the same above and below the ground-water surface. The gravity concentration of gold, which gave rise to the rich pockets along the outcrop formerly mined, is not shown by the curves, because of the lack of assay data.

4. The silver content appears to have been little affected by oxidation. There was possibly a slight leaching of this metal, because the proportion of silver to lead is a little less above the ground-water surface. There is no indication of secondary enrichment of silver in the area of the curves.

5. No leaching or secondary enrichment of lead is apparent. Thin sections show local migration of lead and the precipitation of it as cerussite in veinlets cutting primary minerals.

6. The specific gravity of the primary ore changed from about 3.20 to about 2.70 as it was oxidized. Thus, because of the increase in porosity, the absolute amounts of the metals that have not been leached out, such as lead, are about 15 per cent greater than they were previous to oxidation and leaching. Taking this into account, the primary amounts in gold, silver, and lead appear to be increasing downward along this section.

7. The lead and silver curves show a close relationship. This indicates either that the lead and silver are closely associated mineralogically or that they were closely proportional in amount originally and have reacted similarly to oxidation.

8. The vein is richest where it is widest. There is some field evidence indication that the widest parts of the veins were the areas of greatest brecciation along the pre-mineral fault planes and thus the most favorable places for hypogene enrichment.

The fact that primary values are influenced by variations in the width of the veins makes the theory of the deposition of the vein material by the injection of an "ore magma" an unsuitable hypothesis for the origin of the veins of the Santa Barbara camp. It would seem that an injected vein, like a dike, should show a rather constant composition in all its parts.

"Politics" Overshadows Economics in Tin Market, Says Baliol Scott

"THE YEAR 1927 wrote another record in the annals of the tin industry, whether output, aggregate value, or public interest be considered. It is true that a sharp decline in price took place during the second half of the year, but in view of the great increase in production, the aggregate value was a long way ahead of anything previously recorded." The foregoing statement is from a comprehensive review of the tin industry by Baliol Scott, which appears in "Mineral Industry," published this week by the McGraw-Hill Book Company. Mr. Scott continues:

"However, the year was at least as notable for its politics—if one may slightly extend the accepted meaning of the term—as for its economics. Repeated and violent efforts were made to convince the consumer that a restriction policy having the support of tin interests of all degrees and in all parts of the world had been arranged which would maintain tin at about £300 per ton. In London the newspaper press, financial and lay, was mobilized, meetings of shareholders were made the occasion for general propaganda, public functions were staged at which eminent public men voiced the most surprising statements regarding the industry as a whole, and in short tin became for the time being the center of public interest, at any rate in Europe, in the mineral industry.

"What lay behind this remarkable exhibition of the power and at the same time of the impotence of the general press—for the decline in prices in correspondence with the general economic position of supply and demand continued in the latter half of the year and has become much more accentuated since—it is even now almost impossible to say. It was obvious as soon as any precise statements were put out that they emanated from sources which had very little acquaintance with the industry itself, and it is equally clear that the proposals were never seriously considered by the leading interests, whether producers, smelters, or consumers, who represent the permanent and serious part of the tin industry.

"The idea of restricting output with a view to improving prices is, of course, no new one in tin any more than it is in any of the other branches of mining the product of which is subject to price fluctuation. During the period of low prices after the war, attempts appear to have been made by some Nigerian producers to sound opinion in other fields as to the possibility of restricting, but their position was too unimportant, and the obvious difficulties of any practical scheme were so great that the suggestion was ignored and the only kind of restriction practiced has been that which is associated with the forced curtailment of operations due to loss on working lower-grade material. Last year's proposals, however, differed greatly from the earlier suggestions, in that they were made when tin was at a high price, and sought to maintain it at around £300 per ton, and they were recommended largely on the ground of conserving the world's supplies of what were represented to be the dangerously small reserves of tin ore existing in the world today.

"What made the position the more illogical was that the very quarters which were most prominent in supporting the idea were also the most prominent in forming new companies and thus increasing the mischief of increased production which it was desired to restrain. No previous period can be recalled when market views were more influenced by confident assertions concerning novel experiments of all kinds, including at one time the idea of action by the British government along the lines of the rubber restriction policy. The sudden withdrawal of that measure did as much as anything else to confirm the tin industry in the belief that any attempt at restriction along the proposed lines was futile."

Status of Domestic Magnesite Industry

IN THE caustic-calcined magnesite industry producers do not report any material increase in business as a result of the tariff increase brought about late in 1927. The expected competition from South America has been discouraged, but imports from Greece and India have continued. Demand for outside magnesite stucco has diminished and this outlet for caustic-calcined has almost vanished. The use for flooring continues and is expected to increase gradually. A new use has also been developed in precast floor sleepers which have proved to be satisfactory and advantageous. In an effort to increase demand for their product caustic-calcined producers have turned part of their product into the magnesite refractory field. One of the California producers has for a long time manufactured dead-burned magnesite and has found an eastern outlet for the product. Another has been producing a very pure dead-burned product in rotary furnaces, and this has found an outlet in the electric-furnace field. Experimental work is under way to find additional outlets in refractory work, and, although some of these applications are promising, it is too soon for definite conclusions to be reached.

In California one producer is operating one-half of his caustic-calcined kilns and keeps a rotary furnace fully occupied on dead-burned magnesite. Another producer is supplying the magnesia heat-insulation manufacturers, and a third is making both caustic-calcined and dead-burned of special grade. In Washington the largest producer has an outlet for a fair quantity of dead-burned magnesite through connections with an important manufacturer of refractories.

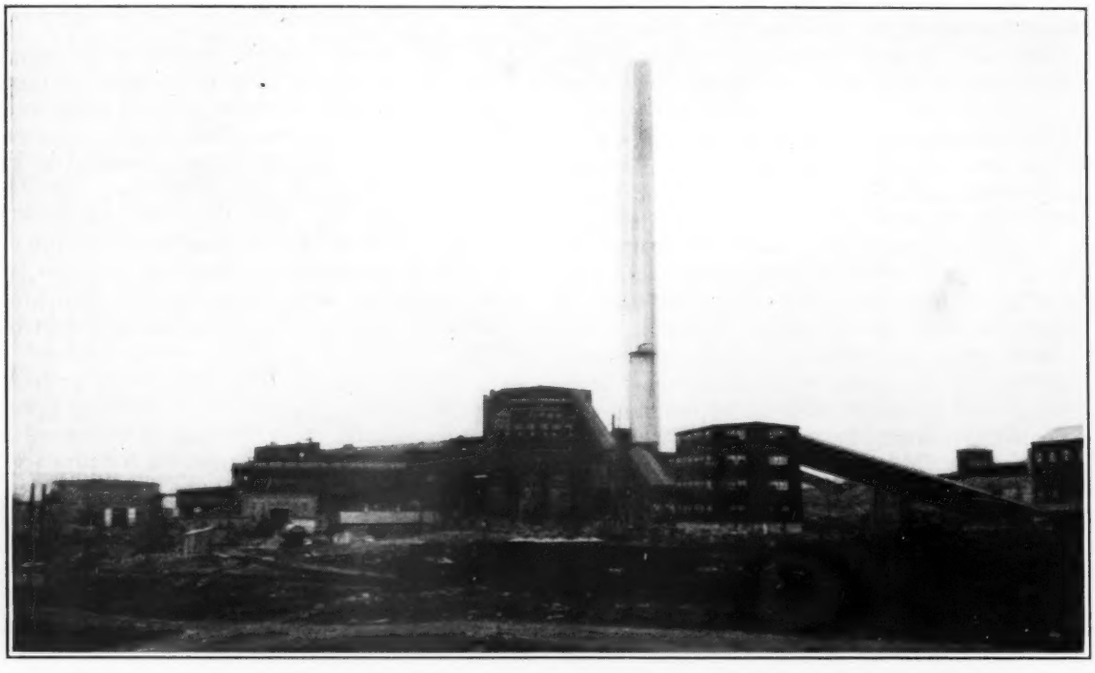
In mining operations producers have advanced development insuring one or two years' supply and generally maintain this position. A large magnesite deposit west of Luning, Nev., was discovered recently, and was offered to various mining companies, but did not excite special enthusiasm. It is understood that a company has been formed to exploit this deposit. Some research work has been done with a view to developing a process for the treatment of the mineral. Other magnesite deposits have been reported, but practically all of them are unfavorably situated with respect to markets and transportation.

The Noranda Enterprise

Part II—The Smelter*

By A. H. HUBBELL
Associate Editor

WHICH is the more important—the smelter or the mine? At the present stage of operation, the only answer possible is that both are of equal importance. Without the Horne mine the smelter would not be in existence today. Time, we hope, will see the plant established on the successful custom basis for which it is equipped. A considerable tonnage of ore will eventually come from the various properties of the district.



The Horne Copper Corporation's smelter, at Noranda, in the Rouyn district of Quebec

How great this will be, or what other districts will contribute ore, only the future can determine. As it is, the existence of ample tonnage for the present purposes has been demonstrated in the Horne.

The work—or ceremony—of blowing in the smelter began on Nov. 21, 1927, when wood fires were lighted in the first of the reverberatories to be completed. Copper was cast for the first time on Dec. 16, and five days later operations were "almost normal," according to the log. At the end of five months of operation the plant had to its credit a production of more than 12,000,000 lb. of blister of excellent average grade. Today it is producing steadily at the rate of 3,000,000 lb. per month.

At the outset Mr. Kenneth Williams was superintendent of the smelter. After the blowing in had been completed, however, failing health caused him to relinquish his duties to his assistant, Mr. W. B. Boggs. Subsequently Mr. Boggs was appointed superintendent, and he acts in that capacity today.

Many difficulties have been encountered, as one would naturally expect. The winter in the Rouyn district is long and severe. Temperatures of 30 and 40 deg. below zero are common. Last winter the thermometer reached 50 deg. below on one occasion. Then, too, skilled smelter labor is scarce, despite the nearness of Rouyn's 4,000 population. Besides the troubles that arise from such conditions, the management has had to cope with those that usually attend the starting of a newly constructed plant.

Despite these obstacles, however, excellent operating results have been obtained. These, together with an account of the difficulties met and overcome, will be set forth in the succeeding pages. Facts to a large extent have been furnished by various members of the staff. These are supplemented and supported by information gained by personal observation on the occasion of my visit during the latter part of June. Through the courtesy of the management, moreover, it is possible to present the smelter log for the period of blowing in.

Work of designing the Horne smelter was started

*Part I, describing the Horne ore deposits, appeared in the issue of Sept. 1.

The converter building last December. The ice is a mute witness of the quality of the weather.

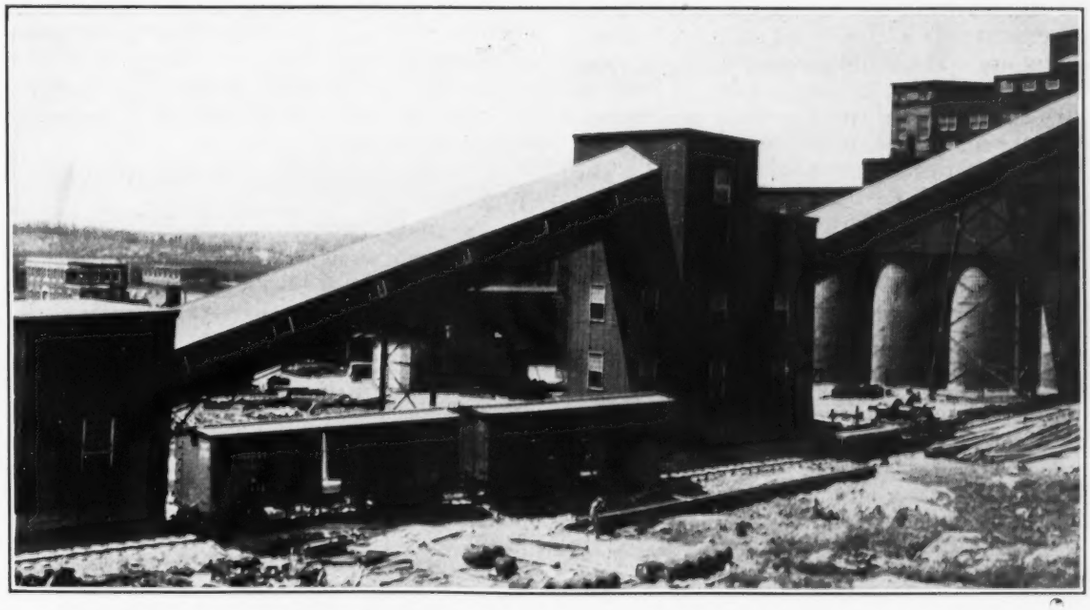
early in January, 1926. Time, climate, and transportation were factors of chief consideration. The interests behind the enterprise wished to get into production at the earliest possible date. A railroad into the district was under construction, but would not be ready until fall. Supplies, such as cement, tools, and the like, were therefore rushed in over the winter roads before the spring break-up, in order that work might be started without waiting for the completion of the railroad. Contract for the steel work was let in May. Erection was not begun until winter weather had set in, owing to delay in finishing the railroad into Rouyn. Work was continued through the winter of 1926-27, despite temperatures as low as 50 deg. below zero. Construction and installation of equipment were pushed steadily throughout 1927, and, as previously has been stated, the plant was blown in before the year was out.

Reverberatories rather than blast furnaces were decided upon by the designers, because it was anticipated that eventually there would be concentrates to handle as well as direct-smelting ore. A capacity of 1,000 tons per day was desired, and to this end plans were drawn for two 500-ton reverberatories, each 25x100 ft. inside the brickwork; eight 8-hearth Wedge roasters, 25 ft. in diameter; two 12x26-ft. Peirce-Smith converters; two casting machines; and all accessory equipment. The most important item of the latter was the coal-pulverizing plant, powdered-coal firing having been decided upon for the reverberatories.

Operating Results

Operating results obtained at the smelter even at this early date have exceeded the designers' expectations. Only one of the two proposed reverberatories has thus far been constructed (work on the other having been held up until a waste-heat boiler can be installed), despite which the amount of ore smelted per 24 hours has already reached the 1,000-ton mark, and this will be increased if the smelter office succeeds in carrying out its intentions. Thus it happens that six of the eight roasters

Another view of the smelter. The sampling mill in the center. Bins of coal-pulverizing plant at right. The Horne office at the left.



are required to feed the one reverberatory. However, this and other details regarding plant equipment and operation will be taken up later in the story.

Ore smelted in the first five months ended June 1, 1928, totaled 103,144 tons. Of this, 79,612 tons was basic sulphide ore, the monthly tonnage ranging from 8,574 in December to 18,080 in June. The analysis of this basic ore was: Copper, 8.10 per cent; gold, 0.232 oz.; silver, 0.84 oz.; iron, 35.20 per cent; sulphur, 33 per cent; silica, 18.2 per cent; alumina, 5.1 per cent; and lime, 1 per cent.

The 23,532 tons remaining was siliceous fluxing ore, containing 54.7 per cent silica; 10.7 per cent alumina; 13.3 per cent iron; 1 per cent lime; 6 per cent sulphur; 2.94 per cent copper; 0.102 oz. gold; and 0.33 oz. silver. The monthly tonnage of this grade rose from 2,166 in December to 6,027 in June.

Basic ore and siliceous fluxing ore were charged to the roasters during the first five months in the proportion

Coarse crushing plant at the smelter

of five parts of the former to one of the latter. By analysis, the weighed average charge was as follows: Copper, 7.22 per cent; silica, 24.50; alumina, 6.10; iron, 31.40; lime, 1.00; and sulphur, 28.40 per cent. It is desired to use as much of the basic ore and as little of the fluxing ore as possible. No oxidized ores are handled. The charge is made up by rule of thumb, the rate of feed being altered by the roaster general foreman, if necessary, in accordance with the results of the slag analysis, posted daily.

Calcine running about 14 per cent sulphur is obtained from the roasters. In the reverberatory this is smelted to approximately a 25 per cent matte when treating a 7 per cent ore. The shrinkage on roasting is about 10 per cent. Theoretically the matte should be lower in grade, but the converter slag running 3 per cent copper, in the form of white metal, is returned to the reverberatory, so that it raises the grade to that stated. The gold and silver content of the matte is irregular, because of the spotty character of the ores in this respect, necessitating careful sampling of the resultant blister.

No limestone or other flux is used in the reverberatory. The average slag for May had the following analysis: Copper, 0.37 per cent; silica, 37.10; alumina, 9.90; FeO, 48.70; CaO and MgO, 3.00 per cent (approximately). So long as the FeO is kept below 50 per cent a slag is obtained that is not too high in copper. The slag is quite pure, the ore containing no metals such as antimony, nickel, arsenic, cobalt, or lead. In April practically the same slag as that in May was obtained. During the first two or three months of operation, a rather basic slag was run, because of lack of siliceous ore.

The output of the converters in the first five months (ended June 1) was 12,030,338 lb. of blister copper, running 99.24 per cent copper, 3.17 oz. gold, and 10.94 oz. silver per ton. No effort is made to produce a blister running over 99 per cent. It customarily runs higher, nevertheless, at times as high as 99.5 per cent. Shipments running 5.16 oz., 5.57 oz., and 5.89 oz. in gold have recently been made. Blister is the only product shipped.

Converter slag at present obtained runs about 25 per cent silica. It is poured back into the reverberatory. The slag desired, and which Mr. Boggs expects to get in time, would run 27.8 per cent silica, 1.95 per cent copper, and 48 per cent iron. For flux he is using a material containing 60 to 65 per cent silica and 8 to 10 per cent alumina. At first this flux was charged to the converters by "boats" and ladles, which caused some trouble in the large converters; but since the installation of the Garr gun there has been no trouble.

The only products retreated are the Cottrell dust, slag skulls, and some matte skulls. Slag and matte skulls are crushed and returned to the roasters, to be intimately mixed with the ore. The slag skulls contain magnetite, which always carries appreciable amounts of copper, gold, and silver. Some of the magnetite is formed in the converters and in the roasters, but there is some of it also in the ore. If a considerable quantity is present, clean separation of metal products is difficult.

The smelter force today comprises 200 men, 135 of whom are on operation and 65 on mechanical work, yard labor, and warehouse. Only 5 per cent of this number are experienced. Skilled labor is scarce. On blowing in the plant, only 12 experienced smeltermen were available, including the smelter superintendent. All save two came from Arizona.

In a region like the Rouyn district, high smelting costs might logically be looked for. Many handicaps aside from climate and isolation have been encountered. Costs equal to those obtained in Arizona have nevertheless been realized, according to Mr. Boggs, without any steam credit for the reverberatories and with a much harder ore to crush and roast. The ore does not decrepitate in the roasters, thus making comparatively fine crushing necessary. The gangue carries considerable diabase (combined silica), which also has to be crushed fine in order that it may smelt readily.

Blowing In the Smelter

Careful record was kept of the succession of events from the time that the wood fires were lighted in the reverberatories until copper was being made on what was considered a normal basis. Inasmuch as smeltermen will find this data of interest, the log is presented in its entirety as follows:

The Smelter Log—Blowing-In Period

1927

Nov. 21—Started wood fires in reverberatory 3:20 p.m.

22—Light wood fires in reverberatory. Distributing belts to roaster bins running.

23—Light wood fires in reverberatory same as 11/22/'27. Little movement to arch.

24—About 100 per cent increase in fires in reverberatory. Arch began to expand about noon. Bricks in ribs began to shear off in early afternoon.

25—Wood fires in reverberatory same as the day before. Not much movement to arch. Started to crush waste rock and siliceous flux about 1:30 p.m. Opening from bin to pan conveyor feeding primary jaw crusher too large. Rock fell over sides of pan conveyor. Probably need sideboards and lower fingers.

26—Wood fires in reverberatory little more than Nov. 25, '27. At 2 p.m. ran crushers and rolls, rolls blocked up with feed. Cleaned rolls, opened them more and started again at 4 p.m. At 4.30 p.m. rolls blocked again. Evidently too much feed. Pan conveyor to primary crusher runs too fast.

27—Wood fires in reverberatory same as day before. Expansion pretty well out of roof over fire.

28—Wood fires in reverberatory same as Nov. 27, '27. Little movement to roof. Crushed about 75 tons of waste rock. Product too coarse. Put timbers in outlet of ore bins to jaw crusher.

29—Wood fires in reverberatory same as day before. Little movement to roof. Arch started to rise. Crushed siliceous flux as it came from mine.

30—Wood fires in reverberatory same as day before. Arch rising slightly. Powdered coal in circulating system to roasters. Coal on furnace for a few minutes to test for leaks. Crushers running all day low tonnage on account of mine deliveries. Weightometer reading 8,925 tons at 1 p.m. No. 2 roaster bedded.

Dec. 1—Two center coal burners on furnace at 8 a.m. Coal screw running 5 r.p.m. × 6 lb. coal = 30 lb. coal per minute. Steel balloon flue opposite bypass uptake flue red, evidently planks in balloon flue. False doors at skimming end partly opened. Arch moving fast all day. Afternoon changed to two outside burners. Balloon flue hot to hand. No. 4 roaster down.
Six small wood fires opposite each door on bottom hearth of No. 2 roaster started at 7 a.m. Small fire started No. 1 converter.

2—About every six to eight hours coal burners are changed on reverberatory, so that only two burners working at one time. This is to keep coal in storage bin on a level. 100 per cent increase in wood fires in No. 2 roaster. At noon cross belt on top of roaster bins working. Started to bed down No. 1 roaster. Not much movement to arch of reverberatory.

3—Finished bedding No. 1 roaster at 8 a.m. Six small wood fires started at 8 a.m. in No. 1 roaster. Bedding down No. 3 roaster and finished at 3 a.m. Crushed 197.4 tons siliceous flux. Power off 7:05-7:50 a.m.; 8:20-9:40 a.m.; 12 noon to 12:30 p.m. Two coal burners on reverberatory. No movement to arch.

4—Sunday. Two coal burners on reverberatory. No movement to arch. Calibrated weightometer on No. 5 belt. Enlarged opening in bottom of mine ore bins to allow large boulders to pass.

5—Roasters 1, 2, 3 and 4 bedded down and 1 and 2 with fires. Before increasing heat in reverberatory waiting to have recuperator finished and some high-grade and run-of-mine ore in roaster bins. Two coal burners on reverberatory and no movement to arch. Preparing bins of No. 5 roaster to use as storage for siliceous ore for converters. Crushed some lime rock. Balloon flue at junction of uptake flue red in afternoon, opened doors at bottom of uptake and at back of uptake. Increased fire on No. 1 roaster, tried coal for ten minutes on No. 2 roaster.

6—Lining coal burners on roasters with chrome brick luted with Thermolite. Two coal burners on reverberatory. No movement to arch. Crushed high-grade sulphide (first day) for seasoning bottom. Too much feed on primary crusher chokes rolls. Start tonight to hoist ore to be put in custom ore bin to avoid delays to crushing in mornings.

7—Two coal burners on reverberatory. Coal burners on No. 1 and No. 2 roasters lined with brick. No movement to arch of reverberatory. Three small wood fires in each No. 3 and No. 4 roasters. Feed to primary crusher too heavy and too intermittent to get good results from rolls.

8—Messrs. Wheeler and Snow arrived in plant today. Mr. W. suggested that bypass uptake from reverb be kept cool; consequently doors in bypass flue were opened wide. Two coal burners on reverb. No movement to arch. Put coal burners (one each) on Nos. 1 and 2 roasters for one hour to try them out. Coal burners on Nos. 1, 2, 3, 4, 5 roasters lined ready for use. Three small wood fires in each Nos. 3 and 4 roasters continued. Same trouble with rolls choking; every time a little oversize piece of ore or limerock gets in rolls, driving belt slips and necessary to shut down to remove the oversize piece. Still think suggestion of weighted idler on driving belt not only necessary but good. Driving pulley on Rolls C came loose today, took 4 hours to put it on. No. 5 roaster bed down.

9—Two coal burners on reverb. No movement to arch. At 7 p.m. raised water-cooled damper all the way to allow hot gases to enter to dry

A storm while construction of smelter was under way

recuperator. Within an hour bricks dropped out of arch at top of uptake and arch at entrance to recuperator. Damper was dropped again and recuperator cooled. Martin replaced brick using Thermolite (about 40) and the damper raised only about 6 in. This was done at 2 a.m. 12/10/27. Wood fires in roasters Nos. 1, 2, 3, and 4.

10—Two coal burners on reverberatory. No movement to arch. Opened four holes inside of furnace (hot-air inlets) under burners Nos. 1, 2, 3, and 4. This caused some trouble by keeping the coal from burning. All burners on the reverb were then raised slightly (about 2 in.) At 8 a.m. water-cooled damper raised up, giving a clearance into recuperator of about 10 in. Coal burned better with burners raised. Recuperators still steaming at the back. Wood fires in roasters Nos. 1, 2, 3, and 4. Grizzly at primary crusher partially destroyed through height of drop of large pieces of ore.

11—(Sunday) Construction department expects to put timbers under grizzly and thus abandon it, tighten up jaws of primary crushers; also tighten up gyratories (secondary crushers). This was done.

12—At 9 a.m. coal burners put on Nos. 1 and 2 roasters. About 4 p.m. charge in roasters (1 and 2) began to roast. At 4:30 p.m. sheared pin on No. 1 roaster and broke two rabbles. 6 p.m. rabbles on No. 2 roaster broken. Shut roasters down at 7 p.m. to dig out fused ore in front of coal burners. At 10 a.m. put four coal burners on reverb. Gas going through bypass uptake and also recuperator. At 11 a.m. cut off cold air fan and started hot air fan. Exit gas (gas entering balloon flue from recuperator) 400 deg. F.; preheated air (entering air duct) 550 deg. F.; furnace gas (entering recuperator) 1,700 deg. F.; fan air 15 deg. F. These temperatures held pretty well all afternoon. The dis-

charge damper from hot air fan partly closed. Gas entering bypass flue about 1,500 deg. F. and this gas entering balloon header flue at about 650 deg. Pyrometer at stack not yet installed. Bottom sand began to fuse in afternoon. Will try to hold the furnace at this temperature all night. At 4 a.m. raised coal and air to furnace. Trouble with fusing of calcines on fifth hearth of No. 1 and No. 2 roaster just under the coal burner from 5 p.m. on. Changed coal burners to fourth hearth so that drop hole was almost under burner and center drop above flame. Finished changing burners on roasters Nos. 1, 2 and 4, at 6 a.m. 12/13/27.

13—Used coal intermittently on roasters Nos. 1 and 2 all day until 4 a.m. Raised wood fires on roasters Nos. 3 and 4 at 4 a.m. About 10 a.m. opened damper wide from hot air fan, gradually increased coal on reverb. In afternoon bottom near skim door was fusing. At 7 p.m. burning at rate of 72 tons of coal per 24 hours. Dropped charge about 7 p.m. (31 cars calcines and 2 cars siliceous flux). Furnace gas entering preheater dropped from 1,875 deg. to 1,775 deg. At 10 p.m. furnace too hot, fire decreased. Charge pretty well smelted at 4 a.m. Fire cut off at 4:10 a.m.; furnace sealed up tight. Preheated air entering air duct at 1 p.m. temperature 780 deg. F. and at slot near firing end of furnace 680 deg. F.; drop of 100 deg. in temperature of preheated air.

14—Put fire back on reverb at 2:30 p.m. Had trouble with draft regulation.

15—Had trouble with draft, finally found best results with baffles in preheater all open, draft in uptake 0.045 in., damper on preheater opened wide, one door in bypass uptake open and bypass damper into balloon flue up about 14 in.; screw feed on coal, one 9 r.p.m., other 10 r.p.m. Between 3-4:30 p.m. CO_2 was 14 per cent, 13.5 per cent, 14.5 per cent. CO was 0.5 per cent but couldn't make oxygen test as solution was no good. First skim 12:20 a.m. to 2:50 a.m., first tap 4 a.m. Started No. 4 roaster at 3:30 a.m.

16—Bridge wall melted down in corners and beginning to melt in center on firing side. Filled up with silica sand. Coal went off 12 noon; back 2 p.m. First blow began 10:08 a.m. in converter. Finished first blow 3 a.m.; 32 pieces of copper. Bricks came out of back of converter, probably caused by frost or lack of expansion between the bricks Matte cold, taking 1 hour to fill ladle.
Brick chimneys over entrance arch to preheater and under Hybnickel tubes filled with coal ash. Pulled out six sets of baffles and cleaned chimneys from top. Baffles not replaced.

17—Opened higher tap hole in reverb at noon; no matte, all slag.

18—8:30 a.m. Small amount of matte went over bay of reverb. Started converter. At 1:25 p.m. circuit breaker on crane circuit in power house tripped. This caused circuit breaker on motor running converter blower to trip also, due to jar. Automatic tilting device on converter failed to work, as it was on transformer on main incoming power line. Consequently tuyeres of converter blocked. Punching out tuyeres from 1 p.m. to 5 p.m. White metal poured on floor.

19—Second converter blow finished at 8 a.m. Had full ladle of copper. Casting machine runs at too low a speed (two molds per minute), made only 95 bars of copper. Balance chilled in ladle. Tapped slag on reverb at 3:45 p.m. All baffles in preheater taken out. Started wood fires in No. 5 roaster at noon.

20—Mr. Colville tested No. 3 coal screw feed to roasters; results show 5.2 lb. of coal per revolution. First day we could weigh charge to reverb. Cars of calcines weighed net 10,185 lb. and 10,370 lb.; car of siliceous flux weighed 8,130 lb. Cars empty weighed 4,300 lb. Started to blow converter on two 8-hour shifts. Charge overblown. Many complaints from men on bad gas conditions. No outlet for gas from converter and reverb. Started today two men to clean uptakes and preheater of coal ash each morning.

21—Operations almost normal.

22—Bridge wall in reverberatory in bad shape. Decided to abandon the hot-air ducts under the furnace, fill them in and use cold secondary air. Owing to the fact that there is a shortage of ore, will cut fire on reverb; air duct under furnace partly filled with slag; digging out slag, cutting out part of conker plate and beams in bridge wall; bricking up ends as well as air duct and filling in with silica sand.

23—Filled in air duct under furnace with liquid converter slag up to within 2 ft. of coal burners on reverb. Gas conditions in building bad.

24—Filled in above converter slag in air duct of reverb with silica sand. Necessary to cut off all fire on reverb for about 3 hours.

25—Christmas Day.

26—Reverb furnace not smelting well. Mr. Williams made gas tests as follows:

	No. 1	No. 2	No. 3	No. 4
SO_2+CO_2, per cent	11.5	16.5	11.0	16.5
O_2, per cent	5.7	1.0	8.0	1.0
CO, per cent	0.0	.....	.....	0.5
Coal screw feed, r.p.m.	9	11	9	10
Draft in uptake, in.	0.04	0.02	0.04	0.02

Dampers on secondary air (cold) were changed. Before last test (No. 4) raised coal feed and cut cold secondary air.

However illuminating the foregoing record is, the full story of what it means to start a new smelter in a subarctic climate in the depth of winter, and, not content with merely getting it tuned up, to begin at once to drive for a record output, may be obtained only by taking up each of the component units of the plant and considering it in detail. This will be done in a subsequent article.

(To be continued)

The Horne smelter and the main shaft, from the town of Rouyn

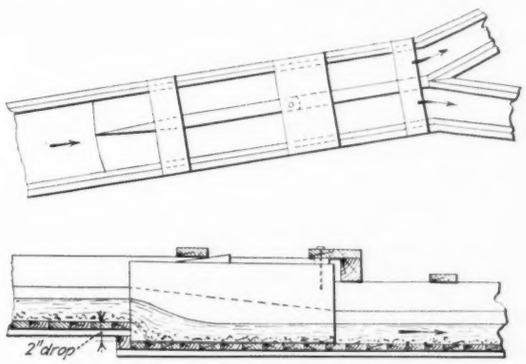
USEFUL OPERATING IDEAS

Launder Splitters

By C. W. Tandy
Winnipeg, Manitoba

IDEA No. 1

LAUNDER streams are best split by a knife splitter as the stream is projected into a drop box, or, still better, by a weir of proportional length. This involves a loss in head, however, which is not always permissible. Moreover, simpler devices lend a strong appeal. The one usually attempted is a tongue pointed up stream and hinged at its base. The lower edge of the tongue is supposed to hug the launder bottom, which is something it can approximate only for a short time until the sand, rolling on the bottom, wears an opening under the lower front edge. Thus, although the splitter may seem to be properly dividing the stream, actually it is not, for the reason given. This is particularly true when the splitter is making a fractional split, other than one-half. To obviate this difficulty it is suggested that the bottom of the launder be dropped an inch or so, as shown in the illustration. Wear will take place, but it will be on the front edge where the stream strikes and not on the lower point. I have never seen this idea tried out, but N. L. Hall, its originator, vouches for its effectiveness.



Improving a tongue splitter for launders

Applying Rope Dressing

IDEA No. 2

ROPE dressing applied at regular intervals is a factor of importance in maintaining the life and efficiency of wire ropes. Various standard dressings are supplied by the market. Their application is a messy job and requires some ingenuity. At the Empire Mines at Grass Valley, Calif., W. W. Whiting, master mechanic, has worked out a scheme which relieves the job of many of its messy features. It is necessary to heat the dressing compound until it is fluid, in which condition it will saturate the rope thoroughly. This is done in a special furnace shown in Fig. 1. A discarded car body of the V-trunnion type was placed in a three-wall inclosure. The front of the car body was bent to form a pouring lip. A handle was riveted to one side of the box and plates were welded into the corners so as to restrict the flow to the pour-out. A light wood fire is used to heat the compound.

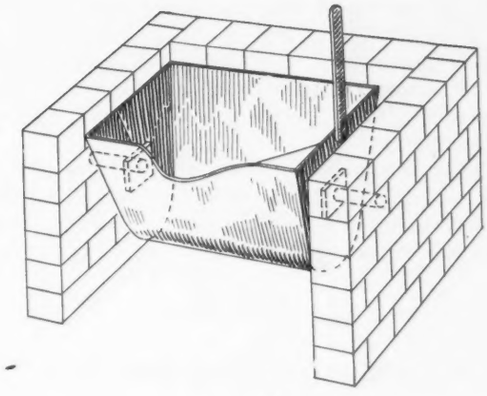
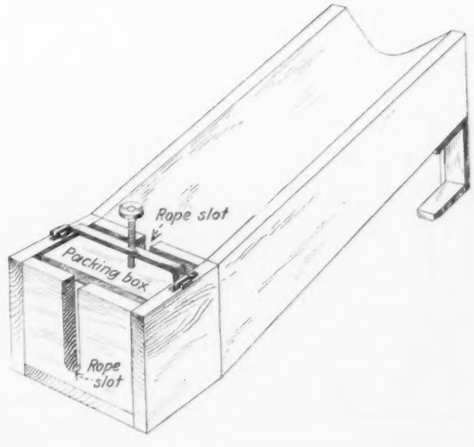


Fig. 1—Heating furnace for rope dressing

A special box is used to facilitate applying the compound to the rope. This is shown in Fig. 2. As the shaft is an incline, the box is designed to accommodate the slope angle. The front of the box is partitioned off, and two slots are cut for the passage of the rope. Tow and waste are packed into this portion of the box and about the rope so as to strip off the excess of dressing and to prevent leakage. A top board and screw are arranged so as to compress the packing about the rope. The prolongation of the box is trough-shaped. The hot rope compound is poured into the upper part of the box as it is needed, the rope being submerged in the liquid for a short length.

Fig. 2—Rope dressing box



Storage-Battery Locomotive Practice

IDEA No. 3

IN CONNECTION with storage-battery locomotives, it is probably well known, although it may be news to some, writes a correspondent, that they should be charged on a thoroughly insulated track; or, better, while standing on wooden rails. This advice may seem unnecessary, but attention to this detail cured a mysterious trouble at one mine.

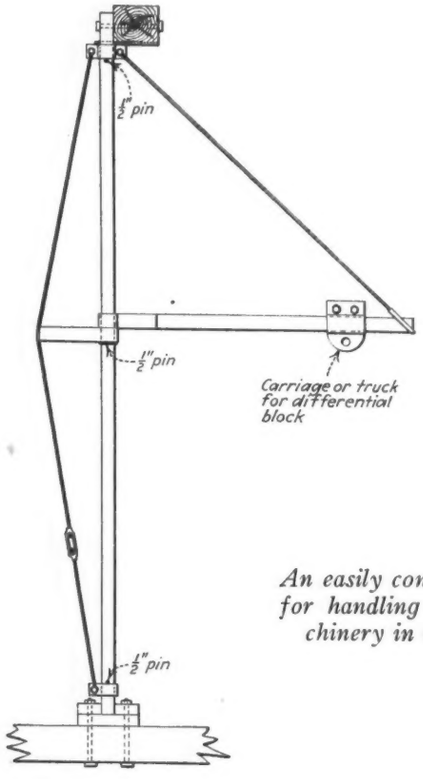
It is recommended that the kilowatt-hour meter be taken off the locomotive and placed on the charging panel. It may be argued that this would take away an instrument that shows the motorman the state of his charge, but the reliability of the modern locomotive makes this point unimportant.

The charging attendant should be capable and experienced and not just a "starter and stopper." Good men are worth their salt on this job. Cleanliness of all charging stations and apparatus, of course, is essential.

A Crane for Shop and Mill

IDEA No. 4

THE accompanying sketch shows a cheap and easily constructed crane used for handling rolls, crusher, and other machinery in mills and shops. The crane is 16 to 18 ft. high, the main column being a 4-in. pipe. The arm is of $1\frac{1}{2}$x4-in. iron and in length about one-half that of the column. Mounted on the arm is a carriage or truck to which a differential block is attached. The truss rod is 1 in. thick and is in two parts connected by a turnbuckle. A crane of this description will handle between 3,000 and 4,000 lb. One stationed between two sets of rolls will serve both. The crane may be moved easily.

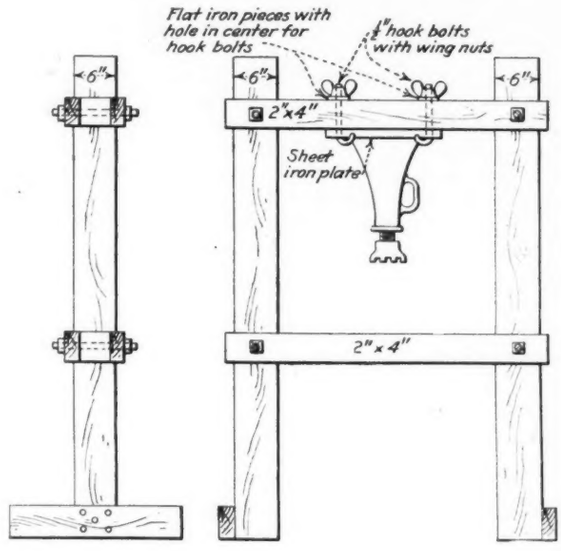


An easily constructed crane for handling crushing machinery in mill or shop

A Shop Press

IDEA No. 5

THE device shown in the accompanying sketch serves as a shop press at the plant of the Compañia Minera Chambas. at Abras Grandes, Cuba. According to T. C. Hulton, the master mechanic, it is used for many purposes, among them that of pressing Diesel-engine valve stems from their cages. It



Jack used for a shop press

may be made of any dimensions of material, and any size of jack may be used. The jack has considerable movement horizontally. Holes are drilled in the jack base for hook bolts.

Increasing the Capacity of a Classifier

IDEA No. 6

AT THE Wright-Hargreaves cyanide plant, at Kirkland Lake, Ont., the overflow from three primary classifiers is pumped to six Callow cones. The overflow of the cones is sent to the primary thickeners and the underflow to a Dorr bowl classifier. At the outset the attempt was made to feed the underflow directly to the center of the bowl. The bowl plugged up promptly, however, and was unable to handle the underflow from more than two cones. This difficulty was overcome by diverting the Callow underflow into the rake compartment. The classifier then took the entire feed from the six cones, in addition to part of the ball mill discharge which it had previously been getting.

A Filter for Liquids or Gases

IDEA No. 7

A FILTER SIEVE for liquids or gases is produced by dipping a woven-wire screen in molten glass or enamel, and applying small fragments of porous lime, charcoal, or chalk before the glass or enamel has time to set. The screens when in use may be saturated with solutions of caustic alkali or chlorine. The foregoing is an abstract of British patent 281,879, according to the *Journal* of the Society of Chemical Industry.

COMMENT AND CRITICISM

Even Scotland Has Had Its Gold Rushes

THE EDITOR:

Sir—In the south as in the north of Scotland "gold fields" exist; the precious metal is there to be picked up occasionally. In the early twenties several Lanarkshire miners, then on strike, found "trovering" for gold in Clydesdale decidedly remunerative. In the north, gold was discovered more than fifty years ago in the Helmsdale Valley, Sutherlandshire, and thousands of adventurers flocked into the district. Hopes ran high with a return of gold to the value of £8,000. In 1911, gold washing was again resumed in the Helmsdale district, but after a short time the enterprise came to an end.

In the south, however, in the wild tracts where rises the Clyde and the Nith, together with a small part of Peebleshire, there is gold also. The district is bleak and sterile, but its moors and its four streams—Short Cleuch, Mennock, Wanlock, and the first of the Clengoner Water—have been associated for centuries with gold and its seekers. Shepherds still find an occasional grain of the metal in the channels of the streams and burns, and at the foot of the glens.

Cornelius de Vois obtained permission in 1567 to "break the ground, mak sinks, and pots therein, and to put labourers thereto." He had six score men at work in valleys and dales, together with lads and lasses. Yet neither history nor tradition hints as to the measure of de Vois' success or failure. The next gold adventurer was distinctly fortunate if the "Archaeolokgia Scotica" is to be trusted for veracity. Sir Bevis Bulmer, a master of the Mint to Queen Elizabeth, obtained the right to work the Glengoner Water and environs for gold, and apparently he did wondrous well.

Upon Glengoner Water he built a fair country house; he furnished it fittingly; he kept therein great hospitality; he purhased lands and grounds; he kept much stock; and he brought home a water course for the washing of gold. By help thereof he got much straggling gold on the skirts of the hills and in the valleys, but none in solid places; which maintained himself then in great pomp, and thereby he kept open house for all comers and goers, as is reported. He feasted all sorts of people that came thither. Thus wrote the historian. Tradition corroborates the record as to Bulmer's opulence from Glengoner gold.

Wanlock Head, however, had before that decade contributed to the riches of the kingdom. Stephen Atkinson, writing in 1619 on "The Discoveries and Historie of the Gold Mines in Scotland," tells of one Abraham Grey who wrought out of gold, found on the Lanarkshire waste, "a verie fair deep bason" that held "within the brims thereof an English gallon of liquor." This basin was filled with coined pieces of Lanarkshire gold called unicorns, and both were presented to the King of France by the Regent Morton.

James I is said to have authorized the expenditure of about £3,000 sterling —a big sum in those days—in working Carnwath Moor for gold. And the return was about three ounces! One or two miners did better in 1923. As also did a holidaying prospector in 1925; who picked up his income for two years. But even the Helmsdale Rush cannot be compared for excitement with the rush that accompanied the finding of the precious metal in the east of Scotland some three generations ago. A young man at the Australian gold diggings happened to mention in a letter home that the gold quartz there had a close likeness to rocks on Lomond Hill. This statement his father accepted as fact. The gold fever took the old shoemaker, and, having paid a stealthy visit to the place, he satisfied himself that Davie was right. Evening after evening, the old man furtively made his way to the spot, filled his sack with the rock, and betook himself home by different and roundabout paths to evade prying eyes.

His behavior, his ill-suppressed excitement, and his nightly jaunts caused comment, and then observation on the part of neighbors; and one evening a party of them challenged him as he was filling his sack. By the next forenoon, Kinness-wood and the countryside were gone gold-mad, and the folk flocked in hundreds to Lomond Hill. Some took horse and cart and returned with sackfuls of the ore piled high, and they that had no wheelbarrow staggered homeward with heavily burdened shoulders. Many slept alongside their "claims," and the scene next day defies description. What also defies description was the reaction that same afternoon after it was announced that the sparkling yellow particles were merely pyrites and that the rock was not worth a shilling a ton for road metal. And for that generation at any rate the mere mention of "Davie's Diggings" brought the glint of fury to many decent folks' eyes.

N. TOURNEUR.

Thundersley, Essex, England.

A Plea for Impartiality and Tolerance

THE EDITOR:

Sir—In the issue of Aug. 11, 1928, you say "Limber up the fountain pen and tell us about it," and you further state that you would be glad if we, the subscribers, would comment freely on what is read in the pages of the *Journal.*

In this particular I am reminded of the saying that "the editorial 'we' is ever fatal to rising genius." At times the *Journal* has been fatal to genius and to the propagation of the truth while in the hands of some of its editors, and at one time this policy was carried so far as to exclude facts that should have been given to the public in the manner that a suit at law is handled in a court of justice—by presenting both sides of the evidence.

However, from the earliest history of civilization to the present day, one doctrine has been sedulously inculcated and perseveringly enforced—that certain subjects are too momentous for discussion; that the opinions of our apparent superiors respecting them are to be accepted with reverent submission and without further inquiry; that such questions are to be approached with humble prostration of the intellect; and that the public discussion of principles and doctrines that ought to be believed implicitly on the authority of superiors is in itself a crime.

But, as a man's conduct in this preliminary respect can be known accurately only to himself, laws for the punishment of opinion are acts of injustice and cruelty. Blame thrown upon a man because his opinion differs from that of another is unjust; he has formed his opinion on such evidence as has occurred to him; and the other has done the same.

This view of the subject leads us to charitable conclusions; to mutual forbearance and toleration. We are in search of the truth, but it is never desirable to be misled or mistaken. If I be in error, and my neighbor has discovered the truth, it is the necessary result of his having enjoyed better means and opportunities, natural or acquired, than I have. Ought this to be a cause of anger and animosity against me? My want of knowledge is

a misfortune, not a crime—and charity should so consider it—provided always I do not conjoin bad passions, intolerant behavior, and erroneous opinions.

I am glad to note that the present management of the *Journal* has steered clear of intolerance, and trust that it will be continued. I think of the passage from the Æneid that "Trojan and Tyrian shall be dealt with by me without distinction." All questions should be presented fairly and truthfully, so that no question of doubt may arise when we have occasion to peruse the pages of your excellent magazine.

Inverness, Fla. STRAUSS L. LLOYD.

Economic Waste in Unpublished Reports

THE EDITOR:

Sir—On page 226 of your issue of Aug. 11 there appeared a news item announcing "Forty Scientists in the Field for U. S. Geological Survey." That is as it should be, but what is the good of the field work if the results are not published? During 1924, Mr. Adoph Knopf, of the Survey, made a study of the Mother Lode region of California. Because the money has not been appropiated by Congress, the report has not been published. It would seem a waste of money to have such a study made and then have it grow stale for four years on account of lack of funds for publication.

JEFFREY SCHWEITZER.

San Francisco.

[Our correspondent should not give up hope. Among recent releases from the Government Printing Office is Professional Paper No. 153, entitled "Studies of Basin Range Structure," written by Grove Karl Gilbert, who died on May 1, 1918.—EDITOR.]

Output of the Worker

THE EDITOR:

Sir—Mr. Scott Turner in "How the Mining Industries of the United States Have Met Changing Conditions," is reported in the issue of June 16 as saying . . . "it appears that the average workman of the United States now puts out . . . more than three times as much as the native of France and Australia. . . ." On the face of it this looks pretty bad for this country, but I think the explanation lies more in the vastness of the operations in the United States than in the superiority of the workmen. In Australia we have none of the open-cut mines like the porphyry coppers, nor even any large-scale underground mines of which Inspiration is a shining example. In coal mining the conditions should be more nearly equal, though the Australian miner works only 8 hours "bank to bank." I think the figures are 10 tons to the American against about 8 tons to the Australian.

F. H. JACKSON.

Sydney, N. S. W., Australia

Geology and Dam Construction

THE EDITOR:

Sir—In your issue of Aug. 25, under the heading of Comment and Criticism, I read the synopsis of the comment of Dr. Chester R. Longwell, of Yale University, upon the report of the commission appointed by Governor Young of California to investigate the St. Francis Dam disaster. I do not know what Dr. Longwell's special calling is, but it is evident that he does not know what the field of civil engineering covers. I have been practicing mining and civil engineering and geology for about 50 years, and I never knew when or where a geologist was expected to know anything about supporting power of materials for foundations, stresses, and strains and other essentials which enter into the problems of such work.

The comments impress me as propaganda to declare the geologist in the combinations of the day. In this instance the geology of the site is made the goat. If the dam was safe and sane, as claimed, and the material under the dam as soft and as uncertain as Dr. Longwell sets forth, the dam would be standing there largely today with a deep hole washed out under the foundation, and no such disaster would have resulted. The ends would have remained on the more stable material instead of disappearing, leaving the center portion standing somewhat displaced, according to the aërial photographs and press reports.

Arch dams are suitable only for very narrow canyons with nearly vertical walls. According to Wegman's treatise on dams, uplift and other forces were not taken into consideration in dam design prior to 1895. He is the great authority and compiler of the day, but it is evident that he did not consult Trautwine's handbooks for engineers. There does not appear to be any particular concordance among eminent engineers in dam design. We have the recent instance of the Boulder Dam for the Colorado River as planned by eminent engineers of the U. S. Reclamation Service, where exception is taken as to its feasibility by a special committee of the American Engineering Council, representing 43,000 professional engineers. According to the press reports it is to be used against the Swing-Johnson bill.

In the description of the Coolidge Dam on the Gila River in the November, 1926, issue of *Engineering World*, the author states among the arguments leading up to this special design that "the site proved to be too wide for a variable-radius dam, since the stresses developed reached as high as 922 lb. per square inch in compression and 554 in tension, and there was no way whereby the stress could be reduced sufficiently except by eliminating the arch type." This work is under the Bureau of Indian Affairs.

Now comes the Bureau of Reclamation, with its many dams of the arch type, the latest being the Owyhee Dam, in Oregon, of greater width and depth than the Coolidge Dam, yet the bureau's technicians have designed an arch dam with canyon walls no more firm, or firmer, than the St. Francis or Coolidge Dam sites, and a fault across the foundation area. I am informed by Commissioner Elwood Mead that the design and project were approved by *Engineering News-Record* in its issue of April 26, 1928.

The spring of this year has in its record the near failure of several dams as well as the St. Francis disaster. The Minedoka Dam, on the Snake River, Idaho, a U. S. Reclamation project, had serious leaks develop when it was filling early in the season. The Crane Creek Dam, in western Idaho, a power-project dam, developed a serious leak on one end when filling and it became necessary to let the water out until safety was established. This dam was designed for a certain height, and later the engineers raised the dam an additional ten feet; which it appears it resented, as it began to give in the last stages of filling. The dam near Price, Utah, a combined power and irrigation project, started to fail as it was filling. The press failed to note what the outcome of the incidents were, or the final analysis of cause, but they were serious enough at the time to be thought worthy of newspaper mention.

I think that the geologist would be making a serious mistake to nose into the dam-site business, as it is clearly evident from the reports that he will get it in the neck and have to assume the major responsibility for the failure of these fancy designs with low factors of safety. I would suggest that the beavers be induced to come into the game. They do know how to build a dam on any old dam site they take a notion to. It is evident that the engineering profession is not so certain of the arch types of dams, for if engineers were satisfied with that type they would not be spending $100,000 on the experimental Stevenson Dam, in California, to ascertain the peculiarities and curves of these tricky structures.

During my 40 years' experience and practice in hydraulics I was never inclined to the arch type of dam, except for particularly suitable locations. I think that it is a most serious and criminal matter to locate and design a structure which will not be safe and certain for all time for such projects as reclamation, irrigation and water supply, whereby life and property are endangered by a failure, which invariably will increase in extent and enormity as time lapses. The thing to do in such projects is to work with nature and use nature's forces for stability, and not buck them, as you have to in the variable arch dam. This dam-site foundation business has been run into the ground, as the saying goes, for one can build a dam on most any site if it is properly designed and the right material employed, that will stand practically forever without danger of failure.

WILLIAM HUNTLEY HAMPTON.

Portland, Ore.

By the Way

Ants As Prospectors

IN THE course of the field investigation of a number of fluorspar deposits in New Mexico occasional information of value was obtained from ant hills. A single instance will serve to illustrate their value. In the Little Florida Mountains near Deming, Luna County, a number of fluorspar veins in volcanic agglomerate have been exposed for a short distance. The veins carry iron and manganese oxides, and the outcrop is often concealed. An attempt to follow one of the larger veins beyond the portion exposed by prospect pits failed until the writer resorted to the examination of the materials of the ant hills along the general projection of the vein. This method was found to be successful in tracing veins concealed by surface material. A mineral analysis of one ant hill on a concealed fluorspar vein by the use of Thoulet's solution gave the following results:

	Per Cent
Lights: rhyolite, quartz, feldspars	55.2
Fluorite	22.5
Iron and manganese oxides	22.0

Another case in which the materials of ant hills was of geological use was related to the writer by Mr. W. B. Lang. In an areal field investigation in Idaho in a region of much weathered igneous rock the presence of quartz crystals in the material of the ant hills was found to be a satisfactory criterion for the identification and mapping of rhyolite.—William Drumm Johnston, Jr., in *Science*.

Fire-Mining Methods Used in Michigan 1,000 Years Ago

AN ANCIENT copper mine, 80 ft. long and hidden 30 ft. or more beneath a ledge of copper-bearing rock, has been unearthed near Hay Bay, on the southern edge of Isle Royale, by archaeologists exploring the island, according to a recent Associated Press dispatch to the Salt Lake *Tribune*. Dr. George West, Milwaukee scientist with the expedition, advanced the theory that some early tribe of Indians, perhaps a thousand years ago, dug from the copper veins the ore that was precious to them for tokens, for lance heads, arrow points, and ornaments.

This new copper find, coupled with the recent discovery of a cave of skulls a few miles distant, was regarded of significance in the search for remains revealing the nature and culture of early North American inhabitants. Exploration of the mine led the scientists to believe the work was done by a people not far advanced beyond the Neolithic stage. They found no evidence supporting the theory of some that Norsemen peopled this Lake Superior isle in relatively recent times.

The mine was excavated, the archaeologists said, by the fire and water methods. Fires were built close to the copper-bearing rock, and then water was thrown against it. The miners then plied their hammer stones against the disintegrated rock and cracked it open to extract the copper it contained.

"The New Yorker" Scores a Scoop

OUR esteemed and supersophisticated contemporary, *The New Yorker*, has discovered, as evidenced in a single issue (that of Sept. 1), that Mr. Hoover is an author and a mining engineer, as well as a candidate for the Presidency. It has also discovered that there exists a "McGraw-Hill firm," and that Mr. W. R. Ingalls was once editor of "a mining journal," but, so far, *Engineering and Mining Journal* has escaped definite identification by our merry andrew feuilletonist, in a manner of speaking.

In commenting on "Hoover's Book," to which it refers as "Agricola de Re Metallica," apparently under some misapprehension as to the credit due to the respective authors (assuming, for the sake of journalistic courtesy, that Agricola has before come within the notice of the magazine commentator), the "news," as presented in *The New Yorker*, and entitled "Hoover's Book," follows, in part:

We have talked to a man who used to spend pleasant hours with Herbert Hoover discussing the occurrence of schorl in copper lodes. To him, Hoover is not a politician, but a mining engineer. This gentleman, whose name is W. R. Ingalls, is still as active in engineering as he was twenty-five years ago when he was one of Hoover's professional associates. He has an office in a building in lower Broadway, and a desk covered with quartz, ore, and graphs. Mr. Ingalls is partly responsible for the publication of Hoover's book on mining twenty years ago. In our recent mention of that book, we made an error. Mr. Ingalls tells us the manuscript was not sent to college professors for their opinion, as we had heard. It all came about thus: The McGraw-Hill firm, publishers of technical works, received, in 1908, a telegram from San Francisco signed H. C. Hoover and asking if the firm would be interested in publishing a book on the economics of mining. The head of the book department was new to technical matters, so he asked Mr. Ingalls, then editor of a mining journal, who Hoover was. Mr. Ingalls told him that, in his opinion, Hoover was the greatest mining engineer in the world. The publishers were satisfied with that, and wired a substantial offer to Hoover for his book. One reason they made the offer an unusually high one was that their chief rivals were a San Francisco firm, and Hoover was in that city. He didn't meet his publishers until a few months later. . . . Incidentally, the publishers were surprised when they saw Hoover. He was then just under thirty-five, but looked no older than twenty-five.

The book had a success greater than any other of its kind. Mr. Hoover, as it was explained to us, stripped the complex problems of valuation, organization, and administration of mines to their unchanging essentials. His method of valuation was the first workable one ever expounded in a book, Mr. Ingalls tells us. The work was promptly adopted as a textbook by mining schools throughout the world and is still used in many of them. It has never been found necessary to revise any part of it. Some of the material was a revamping of the text of lectures Mr. Hoover had given at Columbia University.

Mr. Ingalls has an autographed copy in his office of the Hoovers' famous translation of the ancient Latin book "Agricola de Re Metallica." Engineers say it is the most important source and reference book on mining ever written. In case you haven't seen it, it is larger than any volume in your library except the unabridged dictionary. It runs to almost a thousand pages. Mrs. Hoover, who is a fine classical scholar, worked side by side with her husband on this. As she translated from the Latin, Mr. Hoover, walking up and down the room, would, with his wide technical knowledge, study out what the author was driving at and put the thought into suitable English. . . . It took most of their evenings, Sundays, and holidays over a period of five years.

Consultation

Copper Production Costs Higher Than Lead

"What is the approximate cost of producing, by the ordinary smelting method, one pound of blister copper from the average chalcopyrite concentrate, and one pound of lead bullion from an average galena concentrate?"

This question is one that cannot be answered quantitatively with any degree of accuracy. In the first place, an "average" concentrate is an indefinite term. However, assuming the following assays and costs it can easily be calculated that the cost per pound of lead is about 0.55c., and of copper about 1.6c. per pound. Assumptions: lead concentrate assays 45 per cent; roasting costs $0.50 per ton, sintering $1.50 per ton, and blast-furnace smelting $3 per ton of ore; copper concentrate assays 20 per cent; roasting costs $0.50 per ton, reverberatory smelting $2.50 per ton of ore, and converting $6 per ton of matte. These estimated costs are probably high. It is apparent that the grade of the assumed "average" concentrate is a most important factor in the problem. Again, it must be emphasized that the answer to the question is qualitative rather than quantitative; in other words about all that can be said is that the smelting of copper concentrate is much more expensive than the smelting of lead concentrate on the basis of the weight of metal produced.

Incidentally, it may be mentioned that in the United States chalcocite is a more common copper mineral than chalcopyrite.

INDUSTRIAL PROGRESS

The Equipment Review

AMONG the machinery and equipment recently introduced for mining and metallurgical purposes are the following:

A combination ladle-nozzle has recently been introduced by the Joseph Dixon Crucible Company, Jersey City, N. J. The upper half of this ladle is all super-refractory clay and the lower half is graphite. The principal advantage of this nozzle, it is stated, is that the metal can leave the ladle at a much lower temperature than is the practice generally, with the result that a more perfect ingot is forged. This is attributable to the heat-retaining qualities of the graphite in the lower part of the nozzle. This nozzle is made in any size and with the flow hole as required.

Drill Sharpener

A new small-sized drill steel sharpener has just been announced by the Gardner-Denver Company, Denver. This machine has been designated as model DS-3. It has two cylinders, and with it the manufacturers claim they have developed a greater clamping power than is obtainable in any similar machine now offered. They state that it is also faster in operation without slamming or pounding itself to pieces.

A new high-pressure, oil-fired, drill-steel forge, designated as Model DF-1, has also been introduced recently by the Gardner-Denver Company. Its principal feature, according to the manufacturer, is its practically noiseless operation. When the furnace is running at a forging temperature of 2,200 deg. F., conversation in an ordinary tone of voice can be carried on directly in front of it, which is indicative of its quiet operation in comparison with that of the usual high pressure system. Moreover, the operator is protected from the intense heat by a water-cooled shield and an air screen. The lining of the furnace is composed entirely of standard-dimension fire brick with the exception of the ten top brick forming the throat, which can easily be cut from standard brick or can be supplied molded to any desired dimension.

A noiseless forge

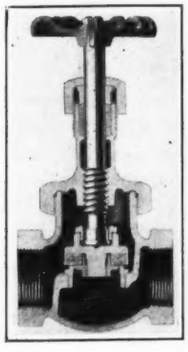
Blowers

Another company to adopt anti-friction bearings for its machinery is the P. H. & F. M. Roots Company of Connersville, Ind. This company has just announced that in the future its own line of blowers, as well at its line of Acme blowers will be thus equipped. The standard line will carry Timken or SKF heavy-duty roller bearings upon the purchaser's specification, and the Acme line of smaller units will carry roller or ball bearings upon specification. The company believes that the manufacture of anti-friction bearings has now been perfected to the point where it is willing to recommend them and to use them. It is pointed out furthermore that a roller bearing has not merely been substituted for one of the adjustable babbitted type, but the standard blower construction has been redesigned entirely, and changed to allow every additional operating advantage. Extreme care has been taken in designing the mounting. Complete protection from the entrance of foreign substances into the bearing housing has been afforded. Ample space is allowed around the bearing for a sufficient supply of lubricant, and provision is made for forcing the lubricant through the bearing from one side to the other. In no case does the maximum load and speed of the bearing selected exceed one-third of the manufacturer's rating. The company claims that aside from the reduction in friction loss, its blowers equipped with anti-friction bearings now offer new possibilities for direct connection to the smaller motors with less horsepower to obtain increased capacities, as well as possessing other advantages.

Bronze Valves

A new line of bronze valves with renewable resilient disks for 250-lb. steam working pressure has been introduced by Jenkins Brothers. This new valve is shown in the accompanying illustration. The disk, being more resilient than the metal, readily conforms to the seat and insures a tight valve without regrinding.

The line comprises globe, angle, cross, and horizontal and angle check patterns, furnished screwed or flanged in sizes ranging from ¼ in. to 2 in. The globe, angle, and cross patterns are furnished with renewable seat rings. The bonnet screws over the body, a construction which adds strength. The bonnet-seat joint is rounded, a feature which also provides strength and at the same time allows easy removal of the bonnet. Other features of the globe, angle and cross patterns include: a non-heating hand wheel of malleable iron; a bronze gland which aids in preventing leakage around the spindle; a deep stuffing box packed with asbestos ring packing, and a manganese bronze spindle with large, powerful threads—all of which are in contact with bonnet threads when the valve is closed.



This new valve has renewable disks

Bowl Classifiers

The Dorr Company has undertaken to build for the Miami Copper Company two bowl classifiers, each 20 ft. wide and 42 ft. long, with 28-ft. bowls. These will be the largest classifiers of this type yet built. Their installation follows that of the largest thickener ever built, namely, a 325-ft. traction unit, installed at the plant of the same company.

Air Filters

A new filter which can be easily inserted in air lines has recently been introduced. The filtering medium consists of felt formed in pockets over radial wire screen fins grouped around a central outlet. This construction permits mounting a relatively large area of felt in a compact space, and allows the use of the entire available area of felt with a negligible restriction. The inserts are of large capacity and are designed to pass 250 cu.ft. of free air per minute. They contain each 20 sq.ft. of felt within a volume slightly smaller than a cubic foot. This filter unit is

inclosed in an aluminum housing, which, in turn, is inclosed in a pressed-steel housing, which, it is claimed, will withstand a working pressure of 125 lb. per square inch. As air enters the top of the filter, it is thrown against the inner wall of the steel housing by a shield. The water, oil, and most of the grit contained are carried to the bottom of the shell where they may be drained off by a cock. All of the remaining foreign matter is said to be caught by the felt. By opening the drain cock and closing a valve to shut off the air going into the filter housing, the air in the outlet pipes or hose is blown back to the filter unit, thus removing all the material on the filter presses. The filter can be cleaned in this way in about ten minutes while in operation. Such cleaning is necessary only once every six months, it is said. The manufacturer is the Staynew Filter Corporation, Rochester, N. Y. The filter is known as the "Protectomotor."

Electric Motors

Announcement of an improved single-phase, repulsion induction motor has been made by the General Electric Company. This motor, in sizes including ¾, 1, 1½ and 2 hp. at 1,800 r.p.m., supplements the company's present line of SCR motors. It is of the constant-speed, high starting torque type for general application. One of the most important improvements is the more efficient use of the stator punchings. This is accomplished by taking full advantage of the design possibilities of the polar winding of a repulsion motor. The most desirable distribution of stator coils in a repulsion motor is a sinusoidal distribution. This means, therefore, that the number of turns in the various coils of any one pole vary according to the angle from the pole center. Full advantage has been taken of this possibility by designing a four-pole motor, using a square punching with graded slot depths, the slots being so arranged that the deep slots are placed at the corners where the maximum core is available and with the shallow slots placed in the flat portion of the punching where the minimum core is available.

Floodlights

A floodlight attachment of new design, for use with small tanks of dissolved acetylene, has been introduced by the Prest-O-Lite Company, New York. The gas tanks are available for service stations throughout the country. The improved attachment as shown in the illustration is of simple, strong, rigid, and compact construction. Universal adjustment is obtained with only one swing joint, minimizing the possibility of leakage.

A floodlight of small size for minor purposes

Engineers Seek Accurate Gage

APPROVAL of the establishment of national standards for pressure gages has been asked of the American Engineering Standards Committee by the American Society of Mechanical Engineers. The standards might provide, for example, for such construction as would prevent the gage from indicating a zero pressure when there is actually sufficient pressure to constitute a grave hazard if an employee should happen to open a boiler or tank. Standardization of vacuum gages is also requested.

If the request is granted by the committee, the next step will be to form a committee of technical experts to undertake the work of gage standardization. Not only will such standardization decrease the accident hazard, but it is expected that it will also benefit manufacturers and purchasers of gages by replacing the great number of sizes and types, now being made, with a comparatively small number of standard sizes and types based upon such a committee's findings.

The Navy Department has done work of importance in establishing gage standards for the use of the Navy, and several private concerns have established specifications for their own use. It is expected that these and other specifications will be studied and coordinated in a national way.

The standardization of pressure and vacuum gages may include, in addition to specifications for accuracy and temperature of calibration, such items as ratings of capacity; arrangement of valuations, numerals, indicator hand and present features of the interior mechanism; also, the position of stop pins. Establishment of standards for test equipment and standard methods for testing gages have also been recommended to the committee.

INDUSTRIAL NOTES

Richard H. Dana, formerly vice-president and treasurer of Hodge and Dana, Inc., New York, is now connected with the Robins Company. He will specialize in the engineering and sale of screens.

The Oklahoma Steel Castings Company, of Tulsa, is enlarging its finishing department. Among the new equipment that it is installing is a complete dust-arrester installation, to be supplied by the Pangborn Corporation, Hagerstown, Md.

Paul H. Peterson, president of Paul H. Peterson, Inc., New York, advises that his firm, which is sole export manager for several machine tool makers, including among them Jos. T. Ryerson & Son, Inc., Chas. F. Elmes Engineering Works, the Vaughn Machinery Company, Milwaukee Electric Crane & Mfg. Company, and the Curtis & Curtis Company, is now undertaking to provide all necessary funds to finance enterprises in foreign countries. It will co-operate with American manufacturers in selling their equipment to foreign countries and will finance long-term credits. The firm will not only finance the buyer but will undertake, wherever found desirable, the complete installation and operation of entire manufacturing plants of the lines which it handles. This includes railway shop equipment, wire drawing plants, road building machinery, wood and iron working tools, furnaces, hydraulic equipment, electric welding, heating and metallurgical plants.

BULLETINS

LABORATORY WARE — Central Scientific Company, Chicago. "The Story of Sillimanite Laboratory Ware"; pp. 32.

ORE-BRIDGE—The General Electric Company, Schenectady, N. Y. Bulletin GEA-723. Coal and ore-bridge equipment for alternating-current operation. Four pages.

CONCRETE — Celite Products Company, 1320 South Hope St., Los Angeles. Bulletin No. 339. The use of Celite in concrete. Sixteen pages.

TRANSMISSION—Stephens-Adamson Manufacturing Company, Aurora, Ill. The JFS variable speed transmission. Four pages.

MOTORS—The Reliance Electric and Engineering Company, 1053 Ivanhoe Road, Cleveland, Ohio, Bulletin 10993. Across-the-line motors. Pages 4.

ARC WELDER — General Electric Company, Schenectady, N. Y. Bulletin GEA-874B. Type WD-200A arc welder, driven by belt, motor or gas engine, stationary or portable. Four pages.

CRAWLER CRANES—Link-Belt Company, 910 South Michigan Ave., Chicago. Bulletin No. 995 describing the company's line of gasoline, Diesel, and electric crawler cranes of capacities up to and including the 2-cu.yd. heavy-duty machine, as well as standard locomotive cranes.

MAGNETIC SWITCHES—General Electric Company, Schenectady, N. Y. Bulletin GEA-19E. Two types of alternating-current inclosed magnetic switches suitable for starting small single, two and three-phase a.c. motors that can be thrown directly on the line. Two pages.

SUPERHEATERS—Foster-Wheeler Corporation, 165 Broadway, New York. Catalog No. 304. This consists largely of illustrations of notable superheater installations, particularly those of the following types: connections, Radiant Heat, combinations, separately fired, waste heat and portable. A steam table extending up to 1,500 lb. absolute pressure and 300 deg. superheat is included.

PATENT

SELECTIVE FLOTATION. No. 1,683,659. Sept. 4, 1928, B. S. Morrow and Ernest Klepetko, Anaconda, Mont.

This patent covers a solution comprising cresylic acid and thiocarbanilid, for use as a flotation agent.

NEWS OF THE WEEK

Summary

MOND NICKEL will follow the lead of International Nickel in increasing the output of its mines in the Sudbury district of northern Ontario, according to an announcement made by one of the officials. Page 428.

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Fire at the main shaft of Kennedy Mining, near Jackson, Calif., on Sept. 7, resulted in a large financial loss and destruction of the new steel headframe being constructed there. Page 427.

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A company with a capitalization of $6,000,000 has been formed by New York interests to operate four mines in the Round Mountain, Nev., district. A large amalgamation plant will be constructed. Page 425.

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Mexico Mines of El Oro will construct a plant to treat the 4,000,000 tons of tailings that have accumulated at the property since it first started producing. Page 428.

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H. A. Smith, of Bisbee, Ariz., has acquired a large group of claims near the New Cornelia mine at Ajo in the hope of developing a low-grade copper property. Page 426.

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Discovery of high-grade gold ore on the property of Trout Creek Mining, near Kirkland Lake, Ont., has caused considerable excitement in Canadian mining circles. Several engineers state that the find has good possibilities. Page 427.

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Improved milling practice, suggested by U. S. Bureau of Mines, is soon to be applied in the Tri-State lead-zinc district. Page 425.

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Crosscutting on 88 level of the Quincy mine, in the Michigan copper district, has cut extension of the rich ore recently found on the 87 level. Page 426.

Evans-Wallower to Build Electrolytic Zinc Plant at East St. Louis

Tainton Process Will Be Used in Handling Low-Grade Western Ores—Joplin Concentrates to Be Treated Only in Case of Overproduction—Capacity Will Be 50 Tons

By J. H. Wadleigh
Special Correspondent

Joplin, Mo., Sept. 10, 1928.—Announcement has been made by the Evans-Wallower Lead Company of plans for the erection of an electrolytic zinc plant at East St. Louis, Ill. The plant will use the Tainton process and is to be built adjacent to the plant of the Monsanto Chemical Company, to which it will deliver its sulphuric acid fumes, and the Cahokia Power Plant of the St. Louis Union Electric Company, from which it will obtain the necessary power. The plant has been designed primarily to handle low-grade Western ores, which are desirable because of their byproducts contents, but Joplin concentrates can be used to advantage when there is an apparent overproduction in the Tri-State district.

Equipment for the plant will include roasting furnaces and Cottrell electrostatic precipitators. There will also be a building containing leaching and purification tanks, filters, and motor generators. It is understood that the output of the plant will be 50 tons of metal a day and that the total cost will be about $1,000,000.

The plant has been designed so that the capacity can be doubled by the erection of duplicate units alongside the original buildings.

Evans-Wallower Lead was recently formed by the consolidation of the Golden Rod Mining & Smelting Company of Joplin with the Evans Lead Company of Charleston, W. Va. The company is capitalized at 12,500 shares of first-preferred 7 per cent stock of $100 par value, and 450,000 shares of no-par-value common stock. Edgar Wallower, of Joplin, is the president. Among the holdings of the company are mines in the Kansas and Oklahoma sections of the Tri-State district, and plants at Charleston for the production of litharge, a monoxide of lead and red lead.

Operator Consolidated Will Explore Two Mine Groups

Operator Consolidated Mines has taken an option on the Oriole group of claims near Douglas, Trinity County, Calif. This property has been explored by tunnels and is equipped with a milling plant. The company is also exploring old mine workings in the Goldfield district of Nevada by deep drilling in the hope of developing a sufficient tonnage to make reopening profitable.

Virginia Buys Combination Mill at Idaho Springs, Colo.

The Combination mill, in the Idaho Springs district of Colorado, has been bought by Virginia Mines. The new owners intend to remodel the plant by equipping it with two flotation machines. Sufficient ore to keep the mill running is said to be insured by reserves at the Revenue mine of the Virginia company, which is also in the Idaho Springs district. The mill will be operated partly on a custom basis.

Arcadian Consolidated Opens Good Ore in New Drift

At Arcadian Consolidated, near Houghton, Mich., the good showing of copper ground in the drift on the 1,700 level of the New Baltic shaft still continues. The drift has been driven on the New Arcadian vein for a distance of 120 ft., all of which is well mineralized with good stamp rock and small masses of copper. A second drill has been added to the equipment, and the work of opening the lode will be pushed. So far, the vein has averaged 6 ft. in width.

Majestic to Sink New Shaft

Majestic Mining is sinking a new shaft at its La Leona mine, in the Totalapam district of Oaxaca. La Leona is one of three silver-gold properties controlled by the company in this district. Output of all three is treated at a 100-ton flotation mill. The properties were reopened in March after being closed down for some time.

New Company to Operate Round Mountain Mines

FORMATION of a new company—to be known as Nevada Porphyry Gold Mines—to operate the four mines at Round Mountain, Nev., recently acquired by Thomas F. Cole and Charles V. Bob of New York, was announced in Tonopah on Sept. 3. It is reported that the new company, which has a capitalization of $6,000,000, will construct a 3,000-ton amalgamation mill to handle the gold ores from the mines. The properties were acquired from Louis D. Gordon of San Francisco and associates, with the exception of Nevada Gold Development, which was the property of John G. Kirchen and Mr. Cole. Round Mountain Mines, one of the Gordon properties, already has a 125-ton amalgamation plant in operation. The accompanying illustration shows the shaft of Nevada Gold Development in the foreground. Properties of Round Mountain Mines appear further back.

Black Bear, in Telluride District, Sold at Auction

AT A sheriff's sale on Aug. 29, the Black Bear mine, situated in San Miguel County, Colo., and owned by Colorado-Superior Mining, was sold to satisfy bondholders' claims amounting to $41,500. A minority group of bondholders, headed by William Shafroth, of Denver, were the purchasers. The mine has been shut down since 1924 as a result of the action brought by the International Trust Company of Denver, trustees under the mortgage, against the Colorado-Superior company.

Colorado-Superior's holdings total 30 claims, 322 acres in extent, near Telluride. The ore is a sulphide, containing gold, silver, lead, zinc, and some copper, and has been developed by a shaft, now about 1,100 ft. deep. Prior to closing down, shipments were made to the Smuggler Union mill at Pandora.

Phelps Dodge Lays New Track to Warren Mill

Grading and track-laying for a new stub railroad to carry ore from Sacramento Hill to the Warren concentrator of the Phelps Dodge Corporation, in the Bisbee district of Arizona, has been completed. The new line has been built through the suburb of Jiggerville, replacing tracks which were condemned because of falling ground in that region. A tunnel was cut through the hill as part of the construction work incident to building the new line.

Jack Waite, in Coeur d'Alene, Starts Shipments

JACK Waite Consolidated, which recently started the operation of its 250-ton concentrator in the Coeur d'Alene district of Idaho, is now shipping silver-lead concentrates to the smelter of Bunker Hill & Sullivan. The concentrates average about 65 per cent lead, 6 oz. of silver, and $1 to $2 in gold. The mill is now handling 200 tons a day, but this will be increased to 250 tons. Shipments are delivered to the railroad by two motor trucks. Drifting is now in progress on the 200 level, where 50 ft. of ore has been found.

Smelter at Errington Mine Will Treat Custom Ores

According to P. R. Bradley, consulting engineer of Treadwell Yukon, which owns the Errington mine in the Sudbury district of northern Ontario, the smelter that will be built to handle the Errington concentrates will also treat custom ores from the district. An additional crushing unit was recently added to the flotation mill of the company, now handling 150 tons of lead-zinc-copper ore a day. The new headframe being constructed at the No. 1 shaft will give greater hoisting capacity and will probably facilitate the handling of 300 to 400 tons a day at the plant. A spur will be built to the main line of the Canadian Pacific Railway for shipment.

Tri-State Companies Will Adopt New Milling Method Suggested by Mines Bureau

By Paul Wooton
Special Washington Correspondent

IMPROVED milling practice suggested by the U. S. Bureau of Mines after extended experimentation soon is to be applied in the Tri-State district. It has been proven that the flint of the zinc belt is no more difficult to grind than is the lead-district dolomite, except that more time is required. Crushers, rolls, ball mills and rod mills have been carefully tested to ascertain the grinding rate. By changing the method of preparing the feed for a certain ball mill, for instance, it was found that 60 per cent additional grinding could be attained without extra cost.

Similar studies made in southeastern Missouri resulted in recommendations as to the classification of ores. As a result, tailing losses have been reduced by more than one-third without increase in costs. By adding a duty to the classifier it has been found possible to eliminate the 14-mesh screens. The new type of classifier was developed by the Bureau's men. It is now being produced commercially by two manufacturers.

The Bureau also has had a hand in the plan to replace with a flotation plant the last roasting and magnetic separator being used in the reduction of zinc. The plant is the one at Platteville, Wis. The method for treating the low-grade jig concentrates was worked out at the Mississippi Valley Experiment station. Mill runs were made in a miniature plant. A three-mineral separation, different from the general flotation practice, was worked out. A marketable iron sinter is produced. At the present plant, the iron can not be thus used, because of the zinc that escapes into the tailings.

Velie Mines Is Sued by Joplin Attorney Over Leopard Lease

A. W. THURMAN, of Joplin, Mo., for a number of years attorney for the Velie Mines Corporation, has brought suit against that company in which he asks that his original agreement with the company in respect to a lease on the Leopard lease of the company be reinstated. Thurman alleges that through misrepresentation he was advised to sell his interest in the lease for $15,000, which today is worth a great deal more.

Mr. Thurman claims he originally sold a one-half interest in the lease to the Velie company for $2,000, with the understanding that he would receive one-half of any amount it was sold for, after the Velie company received the first $1,000. Later he said he was induced to sell this equity in the lease for $13,000. Current reports include the Leopard mine in a deal which would bring the Velie company approximately $1,300,000.

Gold Hill Prepares Plans for Mill Construction

AT GOLD Hill Mining, four miles north of Round Mountain, Nye County, Nev., plans are being prepared for the construction of a mill on the property. A survey for a pipe line to convey water 11,000 ft. to the site of the proposed mill has been completed. Topography and ore occurrence are similar to the Round Mountain mine, in the same district. An incline shaft has been sunk to a depth of 150 ft. and drifts have been driven at 50-ft. intervals.

Gold occurs in a ledge of fine-grained ribbon quartz about 4 ft. wide. The width of the ledge is reported to be practically uniform for the entire depth. On the 150 level, where a crosscut has been driven 200 ft. to the south, a parallel quartz ledge, about 5 ft. wide, has been found, carrying good milling ore. One of the interesting developments at this property is the uniformity of mineralization, the ore assaying from $16 to $18 a ton on all three levels. A hoist, compressor, and machine drills have been installed.

H. A. Smith Acquires Eighty Claims Near New Cornelia

Hoval A. Smith, of Bisbee, Ariz., has taken a bond on 80 mining claims, adjoining the New Cornelia mine in the Ajo district, for a consideration said to be about $1,500,000. Diamond drilling will be started at once on the showings of low-grade copper ore in the hope of developing large tonnages, similar to those mined at New Cornelia by open-cut methods. Some of the claims were owned by Ajo Extension Copper, and the rest by individuals residing in Bisbee, Tucson, and Ajo. Mr. Smith at one time owned a number of mining properties in the Bisbee district as well as the Live Oak group, at Miami, now held by Inspiration Consolidated.

Schumacher Shaft, at Hollinger, Down 4,000 Ft.

Sinking of the Schumacher shaft at Hollinger Consolidated, in the Porcupine district of northern Ontario, has been stopped at a depth of 4,000 ft., the present objective. Lateral work will be started soon, but it will, of course, be some months before much is known of the possibilities of the new section. The mill continues to handle approximately 4,500 tons a day, which is not enough to maintain dividends at their present rate, and it is probable that the directors will have to take some action before long in this connection.

ERRATUM—In the issue of Sept. 8, it was erroneously stated, on page 388, that at the Red Rock quicksilver property "there are about 1,000 tons of ore on the dumps which, it is estimated, will average about 7 per cent." The assay estimate is about 1 per cent.

A Very Disappointing Affair at Empire, Colo.

SHERIFF William Harvey, of Clear Creek County, Colo., realized on Aug. 31 that in advancing on the property of West Forks Consolidated he might once again cause the sounds of ignoble strife to echo in the vales and mountains of Colorado, and bring to the ears of peaceful citizenry such discord as they had not heard since the days when the state was young—with mining in its prime. However, the sheriff in legal matters is a man of adamant resolution. The majesty of the law must be upheld; and he is its sworn upholder. A deputy sheriff had been illegally ousted from the property by Neil Strome, manager of the West Forks company, after the mine had been declared forfeit because of unpaid notes amounting to $7,000. Strome remained in his stronghold with no less than twenty sturdy Colorado orediggers, each amply provided with weapons and ammunition. But Judge Samuel W. Johnson had issued a levy on the property, based on the unpaid notes held by George Wolff, and the sheriff knew that it was his duty to enforce it.

THEREFORE he girded up his loins, issued a statement to The Associated Press—apparently one of the first acts of present-day belligerents—in which he made clear his stand, and gathered a small army of deputies for the attack. Resolutely, after the manner of the King of France, he marched them up the hill, expectant of a sudden salvo from the mine workings. Nothing happened. None of the usual amenities practiced on such occasions in distant days were offered. In fact the affair was almost a total fiasco. Mr. Strome and his followers surrendered in summary fashion and were escorted, after the quaint custom of the region, into jail. Our only satisfaction is derived from the manly conduct of the sheriff, who is hereby named a successor to that illustrious line of heroes in which are numbered Achilles, Alexander, Charlemagne, and Napoleon.

Quincy Strikes Extension of Ore on 88 Level

Quincy, in the Michigan copper district, has cut the main vein in the crosscut from No. 6 shaft at the 88 or bottom level. The lode is described as big and very rich in copper, the same as in the level above. The vein was cut through horizontally and found to be 13 ft. thick, which would give it a width of 7 to 8 ft. Drifting has not yet been started. The continuation of the rich ore found in the 87 level and the unusual width of the lode are considered most encouraging. Meanwhile work of extending the 87 level is proceeding, with no diminution in copper content. The old wooden shafthouse at No. 8 is being taken down and will be replaced with the steel shafthouse from No. 7. Hoisting capacity at No. 6 is being increased.

Three Arizona Quicksilver Mines Consolidate

Three quicksilver properties — the Arizona Cinnabar, Tonto, and Mines Mercury companies—situated in the Mazatzal Mountains, about 80 miles north of Globe, Ariz., have been consolidated. The present plans of the new company are to erect a treatment plant at a central point, with a capacity of about 200 tons daily. Arizona Cinnabar has been operating a 50-ton plant for some time. For many years this district is said to have been practically inaccessible, but recently a good road has been built connecting with the main road through Tonto Basin to Payson.

Sudbury Basin Will Sink a Shaft on Nickel Claims

Sudbury Basin has started development of the nickel properties it recently acquired in the Sudbury district of northern Ontario and will sink a 1,000-ft. shaft at the Falconbridge claim, which was extensively drilled by E. J. Longyear Company. Drilling has indicated about 5,000,000 tons of ore, averaging 3 per cent combined nickel and copper content, within 500 ft. of the surface. In view of the improvement in grade at depth shown by ores in the Creighton and Frood mines it is hoped that the Falconbridge will develop similarly. The shaft will have three compartments.

Three Positions Open in U. S. Bureau of Mines

AN examination is soon to be held to select three engineers to fill vacancies in the U. S. Bureau of Mines, for duty in Washington or in the field. Applications for mining engineer, associate mining engineer, and assistant mining engineer must be on file with the Civil Service Commission at Washington, D. C., not later than Oct. 3, 1928. The entrance salaries are $3,800 a year for mining engineer, $3,200 a year for associate mining engineer, and $2,600 a year for assistant mining engineer.

Full information may be obtained from the U. S. Civil Service Commission, Washington, or from the secretary of the U. S. Civil Service Board of Examiners at the postoffice or custom house in any city.

Mendenhall and Loughlin Visit Helena District

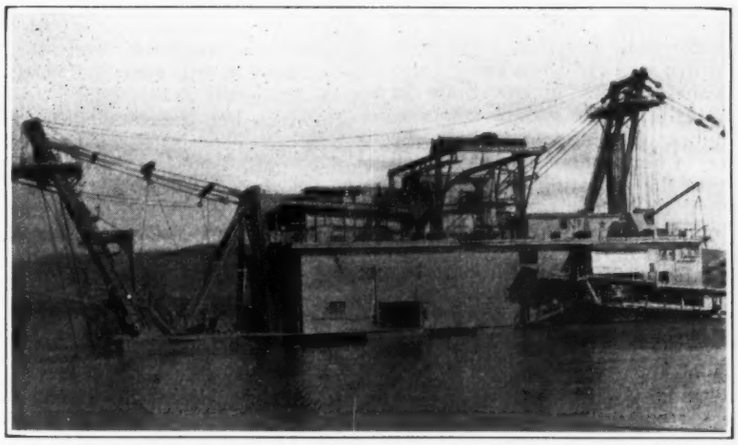
W. C. MENDENHALL and F. G. Loughlin, respectively chief geologist and chief of the metalliferous division of the U. S. Geological Survey, visited Helena, Mont., on Sept. 4 and 5, going over the field work of Messrs. Pardee, Schrader, and Gibson, who are putting in the season in the Helena mining region. A dinner was tendered them at the Placer Hotel, at which Sam V. Stewart, president of the Commercial Club, stated that it was probable that the Government would spend $10,000 in the investigations that it is making in the Helena district, in addition to the $2,500 raised by Helena business men.

While in Helena, Messrs. Mendenhall and Loughlin visited the York district in which the Golden Messenger gold mine is being developed, the old Jay Gould district in which revived operations at the old Gould mine are giving satisfactory results from deeper development, and made an extended trip inspecting several properties under development in the heart of the Boulder batholith, some in the monzonite, others in the andesite areas closely associated with the monzonitic intrusions, aplites, and dacites.

The meeting arranged by the mining committee of the Helena Commercial Club was by way of acknowledgment for the work started in 1926 and continued the following year by J. T. Pardee. The general result, to date, has been to arouse much more interest in this region and state than has been manifested for a good many years.

Shaft at Wenden Copper, Near Wickenburg, Completed

Wenden Copper, operating west of Wickenburg, Ariz., has completed its new shaft to a depth of 1,000 ft. and is developing an orebody, said to average 12 ft. in width. The property, which consists of 11 claims, 220 acres in extent, was formerly worked through a 400-ft. shaft. Ore, in addition to copper, shows a small amount of gold. In the same district, John Jones is operating the Harqua Hala under lease.



One of the dredges of the Natomas Company of California at work near Natomas

Natomas Company of California Is Reorganized

NATOMAS Company of California, engaged in gold dredging and reclamation of farm lands, announced a plan of reorganization recently. The reorganization committee, Silas H. Palmer, James E. Fickett, Louis Sutter and Philip C. Knapp, gave the value of the properties and assets of the company as $6,500,000 and expressed the opinion that much more will be eventually realized under the plan of reorganization.

This company was originally engaged in gold dredging in an area near Natomas, Calif., and was organized to take over Natomas Consolidated of California in 1914. Reclamation and development of farm lands and other activities aside from gold dredging, in which a profit was made did not prove to be profitable and the company failed to prosper. Capitalization was $9,500,000 common and $7,250,000 non-cumulative preferred of which $9,249,500 common and $6,823,000 preferred are outstanding. In addition $10,047,300 of gold bonds are outstanding secured by deed and trust covering all of the property of the company.

The reorganization committee states that the interests concerned will be best served if the property is sold at the earliest date possible in accordance with an existing trust deed, and all the assets of the company acquired under such sale be passed into the ownership of the bondholders through the vehicle of a corporation issuing to them common stock of no par value in exact proportion to their present holdings. The values clearly show that the present preferred and common stockholders have no possible equity in the assets of the corporation that is to be formed.

A reorganization agreement has been drawn up and the American Trust Company, Anglo-California Trust Company and the Bank of California, National Association, have been designated as depositories for the bondholders.

Fire Destroys Headframe and Plant at Kennedy Shaft

ON SEPT. 7, the headframe and plant at the main shaft of Kennedy Mining & Milling, near Jackson, Calif., were destroyed by a surface fire. Fortunately no lives were lost. The fire spread so rapidly as to get out of control within a short time and nothing could be done to save the equipment. The Kennedy mill and office buildings escaped damage.

The men underground at the time escaped through the neighboring Argonaut mine and the north shaft of the Kennedy mine. The new steel headframe, 135 ft. high, which was being built by Moore Shipbuilding of Oakland, Calif., to serve the main shaft, was destroyed as well as the machinery, equipment, and shops. The shaft itself, which reaches a depth of 4,776 ft. and is the deepest in any gold mine in the United States, was damaged but it is believed that this is not serious. So far as is known, no plant insurance was carried by the company and the financial loss is heavy.

Kennedy Mining has been particularly unfortunate in suffering losses from fire. Recently the company lost a suit against Argonaut Mining for damages resulting from the fire in the Argonaut mine which caused the flooding and shutting down of both properties in 1919.

Find, Near Kirkland Lake, Attracts Much Attention

A STRIKE of high-grade gold ore, made on Aug. 14 at the property of Trout Creek Gold Mining, between Kirkland Lake and Swastika, in northern Ontario, has resulted in efforts on the part of several of the important Canadian mining groups to secure control of the company. The property was purchased in 1912 by the present owners but not much exploration, outside of assessment work, was done until this spring. The find was made by Tommy Tennant, a miner in the employ of the company, and is said to show a large amount of free gold. Several engineers who have seen the showing are of the opinion that the formation is favorable for continuation at depth.

Dredges Active Near Nome

OPTIMISTIC reports are coming from Nome as to a revival in gold mining activity there. The rainy season has been favorable for placer operation. Hammon Consolidated Gold, which has hitherto experienced considerable difficulty in keeping sufficient ground thawed ahead of dredging operations to keep its equipment working at capacity, has had better success in that respect this season and expects a larger gold production as a consequence. Twelve dredges have been in operation in the Nome district during the summer and another is being built at Osborn Creek.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Mond Nickel Will Increase Output of Nickel-Copper at Sudbury Mines

TORONTO, ONT., SEPT. 7, 1928.—Although it has been felt for some time that Mond Nickel would follow the lead of International Nickel in expanding its operations, there had been no official announcement regarding this until recently. One of the officials of the company, however, has stated that the Mond output will be increased so as to preserve the present ratio with its larger neighbor. This will involve increases in smelter capacity at Coniston, Ont., to take care of the high-grade copper ores of the Frood mine, enlarging the refinery at Clydach, Wales, and increasing the rolling mill plant at Clearfield, Penn. The Frood property of the company covers part of the same orebody that is being opened up by International. The present shaft, now down 3,000 ft., is of small capacity, and a larger one will eventually be necessary. The Frood orebody is higher in copper and precious metals than the other mines of both companies.

The present ratio between International and Mond, as far as nickel and copper production is concerned, is approximately 65 to 35. Mond ore, however, has been carrying higher values in precious metals than International, and the Mond process of refining gives a proportionately greater recovery. A more complete statement regarding the details of the Mond program of extension is expected shortly.

THE LONG awaited official statement of the Amulet mine in the Rouyn district, Quebec, has just been issued, covering the period from Dec. 31, 1926, to June 30, 1928. The report has proven a disappointment to many people, as the estimate of proven ore is less than expected. A year ago, when new discoveries were being reported almost weekly, newspapers were continually predicting a proven gross value at that time of $12,000,000. The report, however, shows a total of 435,000 tons, averaging $23.31 a ton, or a gross value of $10,116,626. During the last year, not much new work has been done, exploration being chiefly confined to closer checking, and to the development of new orebodies. The ore averages 2.80 per cent copper, 10.60 per cent zinc, 2.84 oz. of silver, and 97c. in gold. The value of $23.31 a ton is arrived at by taking copper at 14c. and zinc at 6c. It will be seen that more than 50 per cent of the value, or $12.78 per ton is accounted for by zinc, and taking into consideration losses in concentration and marketing costs of both copper and zinc, the net smelter returns will be very much less than the gross value. What these returns actually will amount to, will be difficult to estimate until the concentrator has been built. The construction of a mill of 200-ton daily capacity is already being considered for the near future. Concentration tests have been made which indicate that the ore is amenable to selective flotation, and that good recoveries can be made. Transportation of concentrates to the Noranda smelter by aërial tram is also being considered. The report deals at very considerable length with the different ore areas, and the drilling and surface work that has been done. To date, 92 holes have been drilled with a total of 18,213 ft., more than 80 per cent of which were drilled on the No. 4 area.

London Letter

BY W. A. DOMAN
Special Correspondent

Company Is Formed to Work Brazilian Deposits of Manganese Ore

LONDON, AUG. 28, 1928.—A company called Northern & Eastern European Trading Company, Ltd., has acquired from Humberto de Lima the right for a period of five years to work two groups of manganese mines in the State of Bahia, Brazil. These groups comprise fifteen mines. The agreement calls for a division of net profits on a basis of 60 per cent to the operating company and 40 per cent to Humberto de Lima and for an option to the company to purchase the mines during the period of the contract. If the option is exercised, the purchase price will be £10,000 in cash and £30,000 in shares.

Last week I mentioned the fact that negotiations were being carried on for the convening of a conference of lead producers from different parts of the world, with a view to controlling the price. One point about the conference to be called is that so far the Spanish producers do not appear to have been invited to participate. I have heard a certain amount of comment on the omission, and it is not improbable that it will be repaired, as Spain is one of the leading producers in Europe.

DISCUSSION as to the production and consumption of tin continues. As the result of a conversation with a merchant who does a large business in tin it appears that, from his point of view, notwithstanding what has been said in other and also interested quarters, there is overproduction of the metal. He claims to be well acquainted with the situation in the Far East and declares that it is inaccurate to say the Chinese mines cannot be worked at a profit with low prices. According to him, they are still producing. My informant expressed himself confidently that overproduction will continue until well into 1930. America is taking large quantities of the metal, requirements for August being from 400 to 600 tons more than for July.

Mexico City Letter

BY W. L. VAIL
Special Correspondent

Mexico Mines of El Oro Will Construct Plant to Treat Tailings

MEXICO CITY, SEPT. 1, 1928.—Mexico Mines of El Oro has been authorized by the Mexican government to erect a plant at El Oro, State of Mexico, for the purpose of treating tailings from the old mill. As these tailings have been accumulating since 1907, it is estimated that there are about 4,000,000 tons, containing some gold and silver, available for treatment. Construction of the new plant and its subsequent operation insures employment for a large number of the men about to be laid off at the mine and the old mill because of exhaustion of ore reserves.

Some of the mining companies in northern Mexico are having trouble with the mining section of the Department of Commerce, Labor, and Industry, over the interpretation of the rules which exempt them from import duties on articles of machinery and other materials used at the mines. The present tariff apparently clearly establishes these exemptions but the companies are required to deposit the corresponding duties until satisfactory evidence is offered of the destination of the shipments, when the deposits are supposed to be refunded.

IN THE Chilpancingo district of Guerrero, considerable activity has resulted from road construction. The Empresa Metalurgica Florericka, operating properties seven kilometers above the railway bridge at the Balsas River, is driving a tunnel which should cut the Ericka vein about 250 ft. below the surface. Robert Wilson, formerly superintendent at the San Juan Taviche mine in Oaxaca, is in charge of the work. A number of new denouncements were made in Guerrero during August, mostly for claims carrying copper or cinnabar ores.

The War Department is preparing a new set of regulations governing the importation, transportation, and storage of explosives. Details are not yet available nor is the time mentioned when the new regulations will go into effect.

McIntyre Cuts New Ore

McIntyre-Porcupine Mines, situated in the Porcupine district of northern Ontario, has cut the south ore zone near the Hollinger boundary at a depth of 2,375 ft. This ore, as on the upper levels, is rich but erratic. It is understood that the mill capacity will be increased to between 1,400 and 1,500 tons daily. McIntyre mill heads are now averaging about $9 a ton, as compared with $8 during the last fiscal year.

Societies, Addresses, Reports

Manganese Producers Association Holds First Convention

AFTER a year of vigorous work on the part of its officers, the American Manganese Producers Association, which came into being in August, 1927, held its first convention on Sept. 10 and 11 at the Mayflower Hotel in Washington. The developments of the last year, it soon became apparent, had convinced those present that it was entirely practicable to establish in the United States a manganese industry able to supply the needs of steel producers, provided adequate tariff protection be afforded and the necessary financing be secured.

Officers and directors who have served during the last year were re-elected, this demonstrating that the important interests which have been backing the organization will continue to give it their support. J. Carson Adkerson will remain as the secretary of the Association and Richard H. Brown as chairman of the board. The only change made was to increase the number of directors, the following being added to the board:

R. L. Dwyer, vice-president, Anaconda Copper Mining Company.

Herbert Wilson Smith, Union Carbide and Carbon Company.

W. J. Staunton, Cuban-American Manganese Corporation.

O. D. Hutchens, Manganese Ore Company, Watauga Valley, Tenn.

Otto N. Stange, Philadelphia.

W. R. Spencer, Luna Manganese Company (New Mexico), Jackson, Mich.

The directors now number 27, and include, among others, representatives of the Anaconda Copper Mining Company, the New Jersey Zinc Company, the Manhattan Electrical Supply Company, the Butte Copper & Zinc Company, and the Northern Pacific and Chicago, Milwaukee & St. Paul railroads. Anaconda now has two representatives on the board, the other elected last year being William B. Daly, of Butte.

The Secretary's Address

Developments in the manganese industry throughout the world were sketched in the opening address delivered by Mr. Adkerson. Nowhere did he see any condition abroad that was likely to result in a great increase in the shipment of foreign manganese to this country. He cited the encouraging developments at home, such as the starting of the plant, equipped at Butte by the Domestic Manganese & Development Company to nodulize the carbonate ores of the Northwest; the progress made by Wilson Bradley, of Minneapolis, with his process for leaching manganese ores, especially those high in silica; the experiments that are being made at the Bureau of Mines, in Minneapolis, to develop a way of making ferromanganese from manganiferous iron ores; and the increased interest in new manganese mining enterprises throughout the country. In conclusion he asked for the sincere co-operation of the steel companies of the country and urged the railroads to survey the manganese resources along their rights of way.

Reports as to conditions in the various states in which the known reserves of manganese occur, next received the attention of those present. L. B. Miller discussed a phase of the situation in Arkansas, where a large amount of low-grade manganiferous material is known to exist. He referred to the low-grade clays and the experimental work done upon them jointly by W. G. Rinehart, of Batesville, and himself. This work had resulted, he said, in the development of a mechanical method of separating the finely divided oxides or iron and manganese contained. A product was obtained averaging 27 per cent manganese and 20 per cent iron—an attractive material on which to work with some method for further raising the grade. In concluding, he submitted for discussion the thought that the Association's major work was to promote the beneficiation of low-grade ores.

Montana's spokesman was E. L. Blumenthal, of Philipsburg. He said that new steps were being taken to beneficiate the low-grade ores of this camp, formerly mined for chemical and battery ore, with the idea of selling the product to the steel trade. He also described the deposits of the district and the work of the present operators. John H. Cole, president of the Domestic Manganese & Development Company, at Butte, was to have discussed that enterprise, but was kept away by the illness of his mother. Mr. Dwyer, of the Anaconda Company, who presided, therefore, told briefly what the plant was doing. A description of this enterprise was published in the *E. & M. J.*, of July 30, 1927, and Feb. 18, 1928.

Virginia was well represented by C. M. Massie, secretary of the Hy-Grade Manganese Company, of Woodstock; by Dr. J. S. Grasty, of the University of Virginia; and E. A. Fritzberg, formerly of Philipsburg, Mont., and now with the U. S. Manganese Corporation at Stanton, Va. Other speakers in this group included O. D. Hutchens and W. H. Kemler, for Tennessee, and G. M. North, for New Mexico.

Manganiferous Iron Ores Studied

The work of the Bureau of Mines, at Minneapolis, with respect to treating manganiferous iron ores, already referred to, was described in detail on Monday afternoon by T. L. Joseph, of the Bureau. Some progress was being made. At the same session Dr. Oswald Schreiner and Dr. J. J. Skinner, of the Department of Agriculture, described the remarkable results that were being obtained by the use of manganese as a stimulus to plant growth, especially with respect to tomatoes.

The Banquet

One speaker, Major Alfred H. Hobley, of the War Department Air Service, graced the banquet program on Monday evening. His topic, "Strategic Minerals," was ably handled. The United States was not entirely self-contained, he said, though perhaps it was better off in this respect than any other nation. He cited nine strategic minerals, of which we appeared to have scant supplies, and discussed the studies being made to enable the government to overcome the difficulties presented by this deficiency. Three measures were open: To stimulate domestic production, if at all possible; to accumulate a reserve; and to develop substitutes.

Herbert Wilson Smith proved a capable toastmaster on this occasion. At the conclusion of Major Hobley's speech, he scrapped the program and called upon each one present to stand, introduce himself and tell of his experience with manganese. As a result it was close to midnight when the banqueters withdrew. The "experience meeting," as Mr. Smith termed it, proved the most interesting session of the convention.

Minnesota's Manganese Reserves

"Manganese in Minnesota" was the topic of Carl Zapffe, manager of the Great Northern iron ore properties, who led the speakers at Tuesday morning's

Equipment Ordered for Texas Potash Company

EQUIPMENT for mining potash on a large scale in two localities near Midland, Tex., has been ordered by the Standard Potash Company, according to Max Agress of Dallas, president of the company. Core tests of potash beds were made by the company upon its leases in the southwestern part of Midland County and the southeastern part of Ector County, and mining operations will be started in these two localities. These tests were highly satisfactory, according to Mr. Agress. He returned recently from a visit to the potash mines in France and Germany. He said that German potash interests are much concerned over the extensive potash beds of west Texas and the possibility of their early development.

session. He was on thoroughly familiar ground. He sketched the history of manganese in the Lake Superior region, showing how, when the bessemer process prevailed, this metal was not wanted in the ore; how the production of low-grade manganiferous ores had increased as the open-hearth process grew in favor and the qualities of manganese were better understood; how shipments from the Cuyuna Range had steadily grown since 1913, although the manganese content of the ore shipped had fallen from 14.72 per cent to 9 per cent; and how the Lake Superior region in general was now shipping annually 2,500,000 tons a year. As to resources, not only was there on the Cuyuna Range alone a reasonably safe reserve of 44,000,000 tons of ores of this grade, he said, but there was also on that range an immense additional tonnage of manganiferous iron formation which contained more manganese than the ore being mined but which had not been regarded as ore because of its high silica content. Today, however, he said it should be included in new estimates because a process (the Bradley) of leaching the manganese contained had been developed, a process in which ore of high-silica rather than high-iron content was preferred. Little had been said about the Bradley process hitherto, said Mr. Zapffe, because it had had to be simplified and because the patenting of various steps had been necessary. This had now been accomplished and shortly its application commercially on a large scale would be seen.[1] Mr. Zapffe said it was now possible to "manufacture" high-grade ore from substances formerly unimportant.

Following Mr. Zapffe, E. F. Burchard spoke briefly, conveying to the convention the good wishes of the U. S. Geological Survey. He described certain work done on manganese by the Survey during the war, and in conclusion presented some bibliographies covering this mineral that would prove valuable sources of information.

At the same session a paper on the manganese deposits of Virginia was presented by Dr. Grasty. These had been given intensive study since the meeting a year ago, he said.

Convention Adjourns

But two papers were on the program of the convention's closing session. One of these, by A. H. Hubbell, associate editor of the *Engineering and Mining Journal*, follows this account. The other, entitled "Grades and Character of Ore Desired by the Market," by J. J. Howard, of E. J. Lavino & Company, was read by M. D. Langhorne, also of that company. After some desultory discussion regarding the financing of the development of manganese reserves, the convention was declared adjourned.

[1]A brief description of this process, as then developed, was given in *E. & M. J.*, of July 30, 1927, p. 183.

Why Development of the Domestic Manganese Industry Should Be Fostered*

By A. H. Hubbell
Associate Editor

TWO years ago former Secretary of Commerce William Redfield brought out a book, entitled "Dependent America," in which he pointed out the dependence of the United States upon foreign nations for many of the commodities that it uses daily in its industrial and social life. He arrayed a large number of substances and articles which are brought from all corners of the earth to supply the needs of American industry and satisfy the demands of the people of this country. Some of these were luxuries which we could do without, if need be. Most of them were raw materials, the lack of which would inconvenience or cripple the industries dependent on them. Among them were thirty commodities to which the War Department ascribed strategic importance with respect to national defense. Of these thirteen were minerals, including manganese. None of them was more important than manganese.

The United States has long been dependent on foreign countries for almost all of the manganese that it uses in making steel. Only during the years of the war, when ships were scarce and submarines active, did it produce enough of it in the United States to satisfy any appreciable part of industry's requirements. This dependence has come about through natural causes. Industry has gone abroad for manganese because there it is more plentiful and of higher average grade and consequently cheaper than at home. But the opinion is spreading that this course is attended with some peril and should no longer be pursued. Manganese is too important.

The Importance of Manganese

All present appreciate that the importance of manganese lies in the fact that it is a prime requisite in the process of making steel, in which no substitute for it has thus far been discovered. Even Germany under the pressure of her desperate need in the Great War is said to have failed to find a substitute. When we consider, then, how basic an industry that of producing steel is, how necessary its products are throughout the whole range of our civilization, and how serious a blow to our national prosperity any setback that it might receive would be, we cannot fail to be convinced that every possible step should be taken to guarantee to that industry an uninterrupted supply of manganese. Here the nation's interest is greater than that of the steel industry itself. It is evident to all, save, possibly, those whose self-interest blinds them, that any lack of manganese will jeopardize the national safety in time of war and its prosperity and well-being in time of peace.

Manganese Necessary in Peace and in War

The need of safeguarding the country's manganese supply against a sudden war that might cut off the foreign sources of supply, on which the steel industry has hitherto been drawing, is too well appreciated to warrant lengthy consideration here. As a primary measure of the program of war preparedness it has been roundly discussed on various occasions in the last eighteen months. Everyone admits the urgency of this need with respect to war. But why talk of lack of manganese in time of peace, the question may be asked. Are there not abundant supplies of the ore abroad in friendly countries? This is true, indeed. But it is also true that the nations who control politically the manganese on which the steel industry of this or any other country depends may truly be said to have it in their power in time of peace to control or injure the steel industry of that country. A world power that is not entirely independent as to its steel supply runs the risk of forfeiting its place, in this age of steel. Security with respect to manganese has its importance in peace as well as in war.

Foster Development by Tariff Protection and Research

It is necessary, therefore, to make the most of the manganese resources within the nation's borders. Only to the extent to which domestic manganese can be substituted for imported ore at the furnaces can the desired independence be achieved. Development of these resources must be fostered in every possible way. How can this be done? Two things are requisite: Adequate tariff protection must be afforded at all times. The present tariff must be continued and, if necessary, increased to a figure that will insure a market for the domestic product. Without this safeguard who would venture upon or continue a manganese mining enterprise? Second, there is research. Research must be promoted by the government and by private interests, in order that processes may be devised for converting the manganese contained in low-grade ores into a form that will be usable at the furnaces. Research likewise is contingent upon the tariff, for without the latter the domestic industry, now in its small beginnings, would cease to exist and neither government nor private capital would be interested in a non-existent industry. Most of those here know how difficult it is for a government bureau to secure a desired appropriation so that it may engage in research to aid a going industry. What chance do you suppose there would be to get an appropriation past the Director of the Budget to aid a non-existent industry?

How ample are the domestic manganese resources of the United States?

*Presented at the annual meeting of the American Manganese Producers' Association at Washington, D. C., on Sept. 10 and 11.

It is declared that a survey reveals but a comparatively small amount of the high-grade ore demanded by manufacturers of ferromanganese. This may be accepted as the truth. Encouragement is nevertheless afforded in the fact that the same survey of these resources in their comparatively little developed state shows a large tonnage of manganese ores and manganiferous material of lower grades. This low-grade reserve will require the beneficiation already spoken of before it can be utilized. In the aggregate it contains an enormous amount of manganese. Surely even an arch pessimist will agree that the chances are excellent that the country's metallurgists and chemists will find a way of converting this manganese into a form that the steel makers will be glad to get. Already they have succeeded notably with the carbonate ores of the Northwest, although that specific problem has only recently come before them. Given further time and the necessary funds, it is entirely reasonable to believe that these researchers will have new successes.

Tariff Opponents Wrong

Opponents of the tariff on manganese are fond of repeating a pat phrase that has gained considerable currency. They will tell you that the best way of insuring a supply of manganese for use in a war emergency, when foreign sources of supply may be cut off, is to pursue a policy of keeping hands off the manganese within the country's borders. They would leave domestic manganese untouched in the ground. To make sure that this is done they would remove the tariff. Existing mines they would shut down indefinitely, allowing the workings to cave and fill with water. Undeveloped unprospected properties, regarding which scant knowledge has thus far been obtained, they would have remain as such. All this to provide a reserve to which the country might turn as soon as war broke out and begin to satisfy its needs.

The exponents of this idea, I think, are wrong. Their proposal will not stand analysis. They greatly underestimate the time that would be required to resuscitate the dead or dormant industry. They fail to consider that in most cases it is a long and difficult task to reopen an abandoned mine and start production, especially a mine in soft ore. The war might end before they succeeded in getting any worth while production. They must be thinking only of shallow surface deposits, worked in open pits, as in the case of the chrome properties in California.

Shutting Down Industry Fatal to Research

Furthermore, by shutting down the industry they would kill research and so be at a loss to utilize the low-grade manganese ore when the emergency arrived.

Moreover, they should remember that they do not really know in any case how big or how small the so-called limited reserve is. On coming to work it in a war emergency they might find it too limited to suffice even for the period of the war. Or if it proved just sufficient for the first war, how would they take care of the war that followed? Their formula, in short, does not work out to the desired answer.

There seems to be little point, therefore, in conserving manganese resources for future emergencies or future generations, irreplaceable though the resources be when once consumed. The metallurgist of the future may not need manganese for deoxidizing and desulphurizing steel. In other commodities it has been customary practice for a nation to develop its domestic resources in line with its immediate needs, knowing that science and research will enable future generations to look out for themselves. Let us work our manganese deposits, then, as present needs may dictate. To this end adequate tariff protection should be afforded.

Reorganization of Tri-State Association at Annual Meeting Is Expected

WITH the holding of the sixth annual meeting of the Tri-State Zinc and Lead Ore Producers' Association, at the Picher offices, on Oct. 8, the association faces one of its most crucial periods, and possibly reorganization, as the meeting also culminates the five-year period for which it was organized. Section 5 of the bylaws of the association provides that: "Each member herein, upon becoming a member by subscribing to the constitution and bylaws, consents to continue his or its membership upon the basis herein stated and subject to the terms of the constitution and bylaws as subscribed or as may be amended, for a term of five years from and after Oct. 1, 1923: Provided, any member may withdraw from this association at any annual meeting by causing to be filed with the secretary thereof a notice of intention so to withdraw at least 30 days prior to the annual meeting."

That the association will be continued seems assured, as even its enemies recognize that it has done good work, under palpably difficult circumstances. Heretofore it has been entirely composed of producers without smelter connections and the financial burden of the association has consequently fallen on about 40 per cent of the producers of the district. The members claim that the results have been equally distributed to every operator of the field. One portion of the membership has been striving for the last two years to liberalize the membership so as to include all of the producers of the field, and thus lessen the financial burden on individual members. It is understood that the entire membership has finally acquiesced in this demand.

Whether a large proportion of the producers can be induced to join a revamped organization, appears somewhat uncertain. Leading operators contend that the outsider will join. More than a year ago, a large number of the "outs" met and sent word to the association that they would join in its activities provided certain fundamental changes were made in the constitution and bylaws. This offer was brought before the board of directors, but no announcement has been made as to its disposition. Refusal to answer this proposal naturally created some animosities toward the association, yet in the main the "outs" are cognizant of the need of a strong association, functioning properly for the benefit of the industry, so it is thought that the association can encompass a large part of the producers of the field. C. F. Dike, of Joplin, manager of the Interstate Zinc & Lead Company, is president of the association.

Safety Meeting Will Be Held in New York, Oct. 2

WHAT has been accomplished in accident prevention during the past year in the Mining Section of the National Safety Council will be discussed on Oct. 2 at the Waldorf-Astoria Hotel, New York City, when the delegates participate in the seventeenth annual safety congress. There will be no charge for admission, and both members and non-members will be welcome to attend all sessions.

Howard I. Young, vice-president of American Zinc, Lead & Smelting, Mascot, Tenn., is scheduled to speak on "Safety Pays," and H. A. Gilbertson, director of personnel, Lehigh Coal & Navigation Company, Lansford, Pa., will discuss "Methods and Results of Improved Foremanship Conferences."

At the meeting of the section on the morning of Oct. 3, Cleveland E. Dodge, vice-president of Phelps Dodge Corporation, New York City, will deliver an address, "Educating the Miner," and S. P. Howell, explosives engineer of the U. S. Bureau of Mines at Pittsburgh, will talk about "The Safe Handling of Explosives Underground." Election of officers will follow.

A luncheon meeting will also be held on Oct. 3, when D. D. Muir, vice-president of the U. S. Fuel Company, Salt Lake City, will discuss "Safety—A Common Denominator of Coal and Metal Industries." There will be a round-table discussion of "The Safe Handling of Men on Cages."

On the morning of Oct. 4, there will be a discussion of "The Management Believes in Accident Prevention" and "Fires in Metal Mines—Causes, Prevention, and Methods of Handling."

The committee in charge of the program has several other features, which will be announced later.

BOOK REVIEWS

Linking Producer and Consumer

THE SALES ENGINEER. By Gilbert Rigg. Mining Publications, Ltd., Salisbury House, London, E. C. 2, England. Pages 112. Price 10s. net.

MR. RIGG'S conception of a sales engineer, as indicated in these anecdotes of his own experience as such, is that of an engineer, quick witted, well trained, and able to advise customers on the spot in case problems arise involving his company's product—this in contrast to the type of individual who simply reports conditions to the home office and lets some one else find the answer. But "if he ever makes any attempt to sell anything, he makes a mistake. . . . It is not part of the job. A sales engineer is not a salesman." Instead, his main function is to act as interpreter between the producer and consumer. "He must have a leg in each camp."

Zinc, zinc oxide, and other products furnished Mr. Rigg with much food for thought when, as sales engineer for the New Jersey Zinc Company from 1911 to 1916, he had to investigate diverse problems connected with their use in the paint, rubber, and galvanizing industries, as well as in the rolling mills. The story of these years, as he tells it, is full of interesting facts regarding zinc, and is often humorous. He imparts advice freely to the young man following in his footsteps. The actual training of the sales engineer can be obtained only in the field, he says, and he is fortunate if he begins his operations under the control of an experienced chief. He must have served in active operation in the producing plant, and have a clear idea of how the material he is dealing with is made and what are its chemical and physical properties. He must also know what changes can be made either in process or product to meet a given requirement, and must understand the economics of his industry. Solution of a problem calls for knowledge plus imagination.

In conclusion, Mr. Rigg, who writes from Melbourne, pays a lengthy tribute to the work accomplished by the American Society for Testing Materials, with which he was associated for several years. It is a pity, he thinks, that operations of a society of this type cannot be extended all over the civilized world.

A. H. HUBBELL.

TESTING STEEL FOR WEAR—"Wear Testing of Various Types of Steel," is the title of a paper by J. M. Blake, which has just been issued in reprint form by the American Society for Testing Materials, at Philadelphia. The paper describes apparatus developed to test the resistance of metal to abrasion under so-called "wet grinding" conditions. In principle, the machine is a very accurately controlled grinding machine in which all conditions as to abrasive, pressure, speed, time, and moisture, or other liquid contents are under the control of the operator. It is possible to approximate any given set of field requirements. The wear is measured by the amount of metal worn off in approximately 15,000 ft. of travel at a speed of 125 ft. per minute, using a pressure of 50 lb. per square inch on a testing face of approximately 3 sq.in. The wear is expressed as the ratio of wear loss as compared with a standard (commercially pure iron) at 100.

FRANKLIN FURNACE—The origin of the zinc deposits of Franklin Furnace, N. J., is discussed by A. A. Fitch, in a three-page article in *The Mining Magazine* for August. In conclusion, Mr. Fitch summarizes the history of the deposits as follows:

"(1) The Franklin limestone was formed as an ordinary sedimentary limestone, without the detrital blende hypothecated by some writers. (2) The Bryam gneiss magma was intruded, some of its minor constituents segregated, and differentiated into two parts, both in the oxidized condition: (*a*) a non-volatile, iron-rich fraction; (*b*) a more volatile, zinc-rich fraction. (3) The whole area was metamorphosed, involving recrystallization of the ore and limestone country rock. (4) Pegmatite veins were intruded, which still further recrystallized the ore and limestone along its margins, and resulted in the formation of some new minerals."

GOLD MINING, HALIFAX—The Montague gold field, which is situated about 6 miles northeast of Halifax harbor, is the subject of a two-page article by Sydney C. Mifflen, in the *Canadian Mining Journal*, of Aug. 17. Mr. Mifflen states that the recorded output of the district is upward of $900,000 from about 28,000 tons of ore crushed, or an average of $32 per ton. Practically the whole district is now under lease to the Metals Mining & Smelting Corporation of Canada.

THE KENTUCKY GEOLOGICAL SURVEY—It is announced from Frankfort, Ky., that the state geological survey now has available, at nominal charges, nearly 100 separate topographical sheets, over 300 maps, and about 60 bound reports. These may be obtained by addressing the director. The personnel of the survey now totals about 100, of whom 25 are assigned to geological and mineral resource investigations and the remainder to topographic work.

GEOLOGY—A publication of the U. S. Geological Survey, recently received, is Professional Paper 153 entitled "Studies of Basin Range Structure." The author is Grove Karl Gilbert. The manuscript contained is published essentially as left by Mr. Gilbert at the time of his death on May 1, 1918.

GEOPHYSICS—Accompanying the August issue of *Mining and Metallurgy* is a paper (Technical Publication No. 122) entitled "Electrical Prospecting for Molybdenite at Questa, N. M." The authors are Karl Sundberg and Allan Nordstrom. The paper was presented in abstract form at the Boston meeting of the A.I.M.E. The survey referred to was carried out during October and November, 1927, by the authors.

Two other papers on geophysics, also presented at the Boston meeting of the A.I.M.E., are entitled respectively as follows: "Geophysics and the Mining Engineer," by Allen H. Rogers, and "Electrical Prospecting Applied to Foundation Problems," by Irving B. Crosby and E. G. Leonardon.

A NEW TIN SMELTER—The ceremony, on July 13, of starting the new Penpoll tin smelter, erected by the Anglo-Oriental Mining Corporation, at Bootle, near Liverpool, England, is described briefly in the August issue of *The Mining Magazine*. The present capacity of the plant is somewhat over 12,000 tons per year. This can be raised to 18,000 tons by increasing the reverberatory capacity, it is said. Concentrates for the plant will be obtained from the Nigerian and Malayan properties of Anglo-Oriental.

DUST PREVENTION—*Der Bohrhammer*, No. 80, published in June, 1928, contains a three-page article entitled "Dust Prevention Apparatus in Machine Rock Drilling." The article is in English. This magazine is published by Flottmann A. G., Herne, Westphalen, Germany. The English edition may be obtained gratis by writing to the foregoing address.

WIRE ROPE INSPECTION—The *Travelers Standard* for August contains a three-page article pointing out the importance of frequent inspection of wire rope. This inspection, it is stated, should serve not only to determine the actual condition of the rope itself, but also to disclose improper practices or bad set-up that will tend to shorten the useful life of the rope.

MINERAL RESOURCES—The Division of Mines of the State of Tennessee has issued its annual report for 1927 on the mineral resources of the state. The larger part of the volume is devoted to the subject of coal. The remainder deals principally with cement, clay, iron ore, and phosphate.

BAUXITE ANALYSIS—No. 1, Vol. 1, of the Bureau of Standards *Journal of Research* for July, 1928, contains an article entitled "Analysis of Bauxite and of Refractories of High Alumina Content." The authors are G. E. F. Lundell and J. I. Hoffman.

MINING METHODS—Charles A. Mitke is the author of a paper entitled "Comparison of Branch Raise and Combined Shrinkage and Caving Methods," which was presented at the Los Angeles meeting of the A.I.M.E. held there on Sept. 10-13.

Personal Notes

EDWIN S. GILES, mining engineer of Goldfield, Nev., was recently in Los Angeles on a visit.

CHARLES MCCREA, minister of mines for Ontario, sailed for England recently on personal business.

GEORGE A. EASLEY, mining engineer of New York, has gone to San Antonio, Tex., for several weeks.

H. G. FERGUSON, of the U. S. Geological Survey, has gone to California to study conditions in the Alleghany district.

LOUIS V. BENDER, superintendent of the Anaconda reduction works at Anaconda, Mont., has been elected president of the Montana Society of Engineers.

JOHN SMEDDLE, of Fontana, Calif., has been in San Diego County, Calif., and is now at Hot Springs, N. M., for the Fluorspar Mines of America, a New York company.

DOUGLAS A. MUTCH has returned to Toronto from the Chibougamau mining district in eastern Quebec. He confirms reports as to the mining possibilities of the district.

J. A. SWART and MRS. SWART left New York on Sept. 8 on the Homeric for Northern Rhodesia, where Mr. Swart will be engaged in construction work at Roan Antelope.

B. S. BUTLER, of the U. S. Geological Survey, has finished his field work in the Alma mining district of Colorado and is returning to Tucson, Ariz., to resume his work with the University of Arizona.

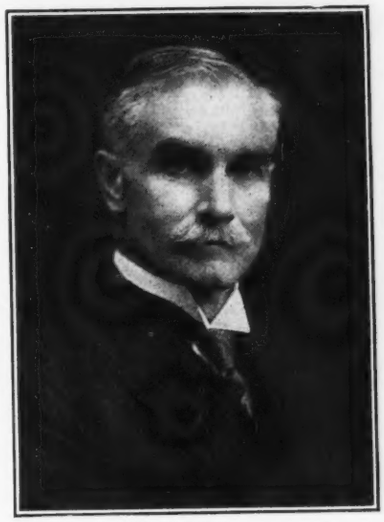
J. P. GRAVES was elected president of Constitution Mining & Milling, which controls properties in the Coeur d'Alene district, on Aug. 28. Mr. Graves plans an increase in the output from the mine on Pine Creek.

H. H. KNOX, mining engineer and geologist, and former president of the Mining and Metallurgical Society of America, is at the Mount Isa mines, in Queensland. The selection of a method of treatment of the silver-lead-zinc ore developed there is under consideration.

CARL BURG, assistant master mechanic of the Midvale (Utah) plants of U. S. Smelting, Refining & Mining, has accepted the position of master mechanic at Rhodesia Broken Hill, the new zinc producer in Northern Rhodesia. Mr. and Mrs. Burg left Midvale recently for England.

WALTER R. VIDLER has just returned to Ontario, after a month spent in examining properties in Oregon. After examining several properties in western Ontario, he will visit the Cripple Creek district of Colorado on professional business, remaining there until the end of October.

R. V. AGETON, accident prevention engineer, Tri-State Zinc & Lead Ore Producers' Association, was a visitor in the Salt Lake district last week. Mr. Ageton was returning to the Tri-State district where he will shortly resume his duties following a leave of absence of several months.



ROBERT M. RAYMOND

Prof. E. P. MARTINSON, of the Colorado School of Mines at Golden, Colo., has resigned and will be succeeded by J. C. FITTERER, professor of civil engineering and hydraulics at the University of Wyoming. Professor Fitterer was at one time connected with the U. S. Geological Survey.

E. J. BUMSTED, who was in charge of the property of Humboldt Mining, State of Nayarit, Mexico, is still in the hands of Mexican bandits who plundered the property on Aug. 25 and kidnapped him. The bandits have demanded a ransom of $10,000, American currency, and this has been forwarded by the company.

ALFRED L. ANDERSON, of the Idaho Bureau of Mines, recently completed a survey of the Roundtop and Marble Creek districts of Benewah County, Idaho. As a result of his investigations, Mr. Anderson feels the Roundtop district is worthy of systematic exploration. Mineralization is said to be similar to that of the Pine Creek section of the Coeur d'Alene district.

OBITUARY

JOSEPH PHAROAH, shift boss at the Copper Queen branch of Phelps Dodge Corporation, in the Bisbee district of Arizona, died recently at the Copper Queen Hospital, following an illness of several weeks.

WILLIAM MILEMAN, a pioneer on the Rand gold fields of South Africa, died at Johannesburg recently at the age of 76. He was formerly associated with the Jubilee and Salisbury gold mines. Mr. Mileman took an active part in the Zulu War and was one of the few who escaped from Isandhlwana, where 800 Europeans were massacred.

DR. ALFRED S. MILLER, founder and first dean of the Idaho School of Mines, died recently at Moscow. Dr. Miller was head of the mining division of the University of Idaho from 1897 to 1905. He was a graduate of Stanford University and subsequently attended Heidelberg, from which he received his doctor's degree. He engaged in mining engineering at Auburn, Calif., before coming to the University of Idaho. Shortly before his death he gave his mining library to the university.

F. E. BEASLEY, mining and metallurgical engineer with Bunker Hill & Sullivan in the Cœur d'Alene district of Idaho, died Aug. 31. Mr. Beasley was the brother of Alfred F. Beasley, who recently was appointed superintendent of the Bunker Hill smelter to succeed the late M. H. Sullivan. After graduating from the University of Illinois in 1904, Mr. Beasley joined the staff of the Tacoma smelter. Subsequently he was associated with Consolidated Mining & Smelting of Canada, at their electrolytic plant at Trail, B. C., and with Burma Mines at Namtu, Burma, India. He then joined the Bunker Hill staff and engaged in research work on the Tainton process at Kellogg, Idaho.

Robert Matthew Raymond—

An Appreciation

AS ONE who has been associated with the late Professor Robert Matthew Raymond—who died at Prescott, Ariz., on Aug. 23—for the last 26 years, I wish to pay tribute to his qualities as a man and an engineer, sentiments which I feel sure will be endorsed by all who knew him.

Dr. Raymond's keennees and ability underground were fully demonstrated by the development of the properties of El Oro Mining and Railway Company, Ltd., and the Mexico Mines of El Oro, and his metallurgical knowledge by the equipment of these mines.

Soon after leaving Mexico he shared offices with me in New York and undertook the position of Professor of Mining Engineering at Columbia University, where his interest in his work and his sympathy for his students made him an outstanding character.

As a man, his cheerfulness, his understanding, and his kindly nature, as shown by his numerous charities, could not fail to make him beloved by all who came in contact with him.

Dr. Raymond's ambition was to set a standard for the mining course at Columbia that would put it ahead of any other course in this country. His death will be deeply felt by all those who have studied under him. His friends and associates fully realize a great nature has left them. PHILIP L. FOSTER.

New York City.

MARKET AND FINANCIAL NEWS

Value of Canadian Silver Production Declined in 1927

REVISED statistics on Canadian silver production in 1927 are reported by the Dominion Bureau of Statistics in a recent bulletin. They show a production of 22,736,698 oz., which, valued at the average price for the year, 56.37c. per ounce, was worth $12,816,677, compared with the 1926 output of 22,371,924 oz., valued at $13,894,531, when silver averaged 62.107c. per ounce.

A small quantity of silver was produced in association with gold in the provinces of Nova Scotia, Manitoba, and Alberta. The Quebec output of 740,864 oz. was contained in silver-lead-zinc concentrates and copper concentrates which were exported for treatment in foreign smelters, and in blister copper made by the Noranda smelter, which went into operation late in 1927.

Ontario produced 9,307,953 oz., 83 per cent of which was in the form of bullion; the remainder was contained in concentrates exported, in gold bullion produced by the gold mines, and in the nickel-copper ores of the Sudbury district.

British Columbia's output of 11,040,445 oz. was greater than in any other year on record. Small amounts were recovered with alluvial gold and from gold bullion, but the Sullivan mine and the Premier mine were responsible for the greater part of the output from this province. The Sullivan, primarily noted for its lead and zinc production, is the largest producer of silver in Canada. Silver was recovered from the copper ores and concentrates which were exported for treatment in foreign smelters and from blister copper made at the Trail and Granby smelters in the province.

Yukon production, at 1,647,295 oz., consisted of 6,925 oz. from the crude alluvial gold and 1,640,370 oz. contained in ores and concentrates exported from the Mayo district.

Production of Silver in Canada, By Provinces and By Sources, 1926 and 1927

	1926		1927	
	Quantity, Ounces	Value	Quantity, Ounces	Value
Nova Scotia:				
In gold bullion	112	$70	125	$70
Quebec:				
In gold ores, in blister copper, and in copper and silver-lead-zinc ores exported	375,986	233,513	740,864	417,625
Ontario:				
In silver bullion and nuggets	7,877,629	4,892,559	8,108,026	4,570,494
In gold bullion	248,887	154,576	266,946	150,477
In slags exported from gold mines	444	276	5,077	2,862
In matte, blister copper, and in silver ores, concentrates, and residues exported	1,148,005	712,991	927,904	523,060
Total	9,374,965	$5,760,402	9,307,953	5,246,893
Manitoba:				
In gold bullion	18	$11	12	$7
Alberta:				
In gold bullion	.....	.....	4	3
British Columbia:				
In alluvial gold	3,764	2,338	1,654	932
In gold bullion	17,179	10,669	2,452	1,382
In blister copper	1,235,398	767,269	964,747	543,828
In base bullion and in ores exported	9,369,475	5,819,100	10,071,592	5,677,357
Total	10,625,816	$6,599,376	11,040,445	$6,223,499
Yukon:				
In alluvial gold	5,702	$3,541	6,925	$3,904
In ores exported	2,089,325	1,297,618	1,640,370	924,676
Total	2,095,027	$1,301,159	1,647,295	$928,580
Total Canada	22,371,924	$13,894,531	22,736,698	$12,816,677

South African Mineral Output Announced for First Half 1928

THE Government Department of Mines and Industries for the Union of South Africa has published returns giving the production and value of minerals and metals in the four provinces of the Union for the first six months of the current year. The statistics are incomplete, because no figures as to diamond outputs and sales are available, it having been decided some months ago to discontinue the publication of periodical statistics relating to the diamond-mining industry. Apart from gem output the value of minerals and metals produced in the Union during the first half of 1928 was £24,397,185, of which gold accounted for £21,712,172 and coal £1,779,537. Copper sales amounted to £305,253 and platinum to £138,426. Tin valued at £118,644 was produced during the six months, and the production of asbestos and other minerals was valued at £242,258. Excluding diamonds, the current half year's production is higher by £359,750 than in the corresponding period of last year. In the January-June period of 1927 the value of the diamond output and sales was £6,672,932, and assuming that production of precious stones this year has been more or less the same as in 1927, the total value of mineral output in the Union for the first half of 1928 may be placed somewhat above £31,000,000.

Great Britain's Gold Reserve Highest Since July, 1914

During recent months the weekly bank returns of the Bank of England have been establishing new records, according to reports from the U. S. Department of Commerce. Returns for the week ended Aug. 22 produced a new record in the proportion of the bank's reserve to the deposit liabilities of the bank, with a ratio of reserve to liabilities of 52 per cent. This is the highest proportion reached since July 22, 1914, when the ratio was 52.4 per cent. A year ago the ratio of the reserve was only 28.9 per cent. The gold cover for notes is now 40.75 per cent.

Utah Copper has increased its quarterly dividend rate from $1.50 to $2 per share. The first dividend at the higher rate will be paid Sept. 29 to stockholders of record Sept. 14.

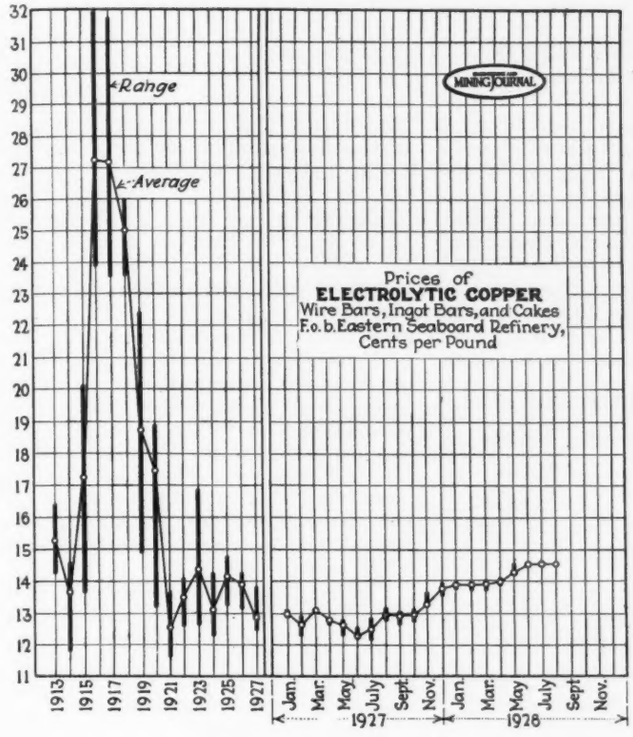
Mexican Metal Production at Higher Rate in First Five Months of 1928

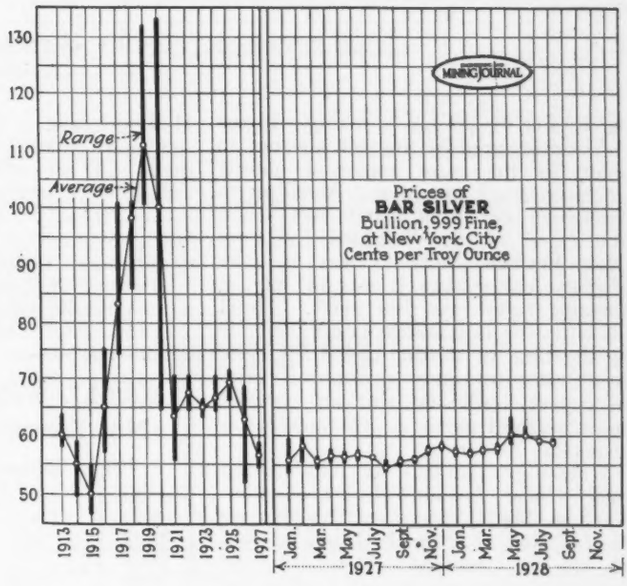
STATISTICS released recently by the Department of Mines of the Republic of Mexico indicate that metal production of Mexico during the first five months of 1928 is at an appreciably higher rate of production than during the corresponding period of 1927. Of the nine metals listed only mercury shows a lower production rate for 1928. Figures represent kilograms.

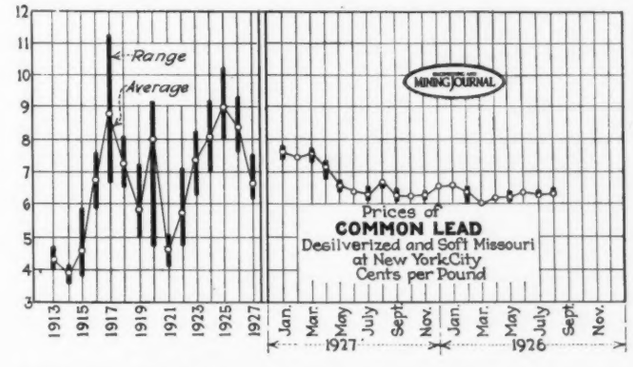
	January to May Inclusive	
	1928	1927
Gold	9,241	9,171
Silver	1,394,711	1,223,897
Lead	100,337,300	81,444,191
Copper	24,107,688	23,498,163
Zinc	66,845,736	46,895,717
Mercury	36,569	37,951
Antimony	799,556	673,495
Arsenic	2,585,208	2,435,427
Cadmium	162,551	.....

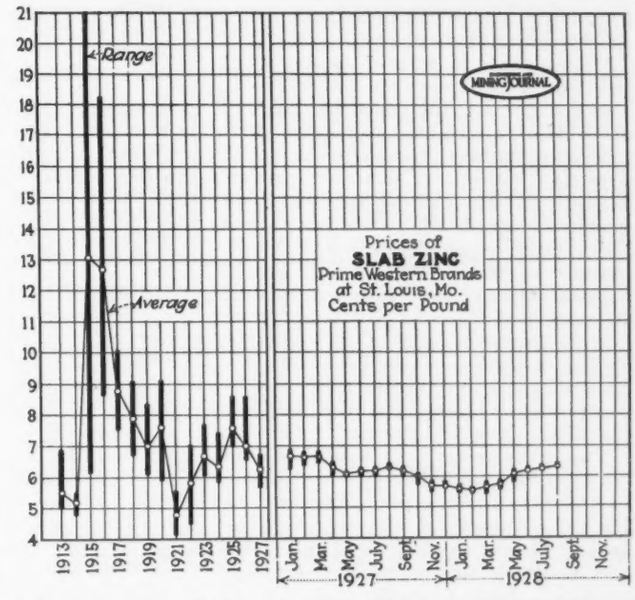
ALASKA JUNEAU in August, 1928, mined and trammed to mill 346,200 tons of ore from which the estimated receipts were $244,500 or 70.62c. per ton. Operating expenses were $181,900 or 52.54c. per ton. Operating profit was $62,600 or 18.08c. per ton. Other expenditures and accrued charges totaled $17,900, leaving a surplus of $44,700.

Metal Price Curves

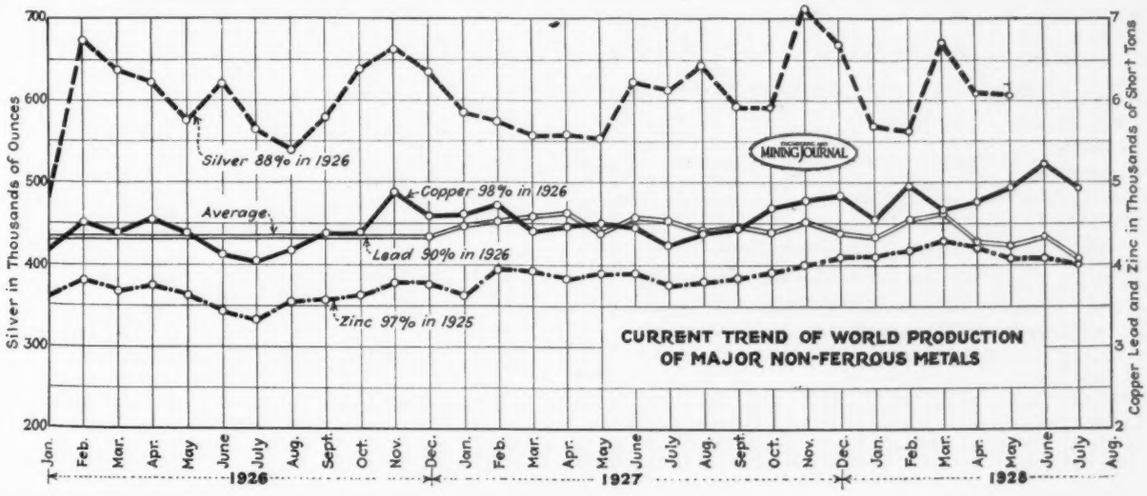








THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926, and accordingly a horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.



Review of Current Statistics

By Homar L. Johnson
Assistant Editor

STATISTICALLY speaking, August was featured by another advance in many of the more important mining company share quotations. Metal prices underwent but slight change and though the *E. & M. J.* Weighted Index of Non-Ferrous Metal Prices is now slightly higher than it was in July, it remains below the 100 mark. Metal statistics for July are the latest available at the time of writing and they show a decrease in daily production rates of copper, lead, and zinc on a world basis, as well as for North and South America.

The slight advance in *Engineering and Mining Journal's* Index of Non-Ferrous Metal Prices for August resulted from fractionally higher prices for tin, zinc and lead. A small decline in the price of silver partly offset the advance. Copper, aluminum, and nickel prices continued unchanged.

The advance in price of mining company share quotations on the stock exchanges late in August carried two of *E. & M. J.'s* weighted indices of stock market valuations of common shares to new high records. The Index Number of the mining-smelting-manufacturing group advanced 28 points above the 203.5 mark recorded in July. Prime movers in this advance were International Nickel, American Smelting & Refining, and Anaconda. The appreciation in quotable value of these stocks, during August amounted to approximately 24, 22, and 14 per cent, respectively. New Jersey Zinc was the only one of the group to decline.

The other record was established by the copper group index, which advanced 14.2 points, to set a new high mark at 158.4, in August. Chile Copper, Kennecott, Nevada Consolidated, and Calumet & Hecla blazed the way for this advance. New Cornelia and United Verde Extension were the only companies included in this index group to decline in market valuation.

An advance in the Index Number for the thirteen miscellaneous mining companies was registered, also, though the current Index Number is below that recorded in the same month last year. The two copper producing members of the group, Cerro de Pasco and Howe Sound, advanced. Three of the five precious metal producers' shares advanced in price; though another large decline by Hollinger and a lesser one by Cresson more than offset their appreciation. Of the other base metal and complex ore producers, an almost unbroken front of higher share quotations was observed; Hecla alone failing to participate in the advance.

To the statistically inclined, August is an appealing month. Of interest to readers of this page will be the following notes on metal prices and mining company share quatotions during Augusts of recent years. First to attract attention is the unanimous advance recorded by the three indices of mining company share quotations last month. A little more attention to the charts on page 437 will reveal that this condition has been completely fulfilled during the existence of these indices—in other words each of the three indices has advanced in each August since their inception. Second to attract attention is the annual August advance recorded by *E. & M. J.'s* Weighted Index of Non-Ferrous Metal Prices. Attention is thus directed to the behavior of prices for the individual base metals. By delving into recent statistical archives the following data are secured. In the last eight years, the August average price for copper was lower than the July monthly figures only in 1923—assuming last month's price, as virtually unchanged from July, which for all practical purposes is correct as the 0.001c. per pound decline is mathematical rather than actual. The August lead price was higher than July's not only for the last eight years, but for three years before that as well. Tin duplicates the record of lead for the eight-year period, and in only one year, 1926, was the August price of Prime Western zinc below that of July.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74
1927	97.54

	1926	1927	1928
January	112.66	100.46	97.54
February	111.91	100.01	96.73
March	108.95	100.84	96.22
April	105.93	98.63	97.14
May	105.43	96.41	99.05
June	106.68	95.55	100.16
July	109.08	95.42	99.69
August	110.22	97.25	99.85

The fact that metal production is generally low in July and August may be a factor in stimulating demand. Then there is the probability that a general quickening of all business activities takes place as the holiday season draws to a close. Likewise some consumers may book their requirements in August for the increased industrial activity of the autumn and early winter months, which would increase the demand temporarily and tend to start prices upward. Even though incompletely explained, the statistics are interesting.

The appreciable decline shown in July world lead production was paralleled by a decline in production at United States mines and at United States and Mexican smelters. Daily rate of refined copper production for North and South America showed a slight decline in July, as did export and domestic shipments. Total stocks increased by some 2,000 tons despite the further reduction in refined stocks to close to 54,000 tons at the end of July. Daily rate of world copper production declined 274 tons.

The decline in daily rate of world zinc production amounted to 121 tons. Domestic zinc deliveries likewise declined, though zinc stocks were lower by 2,258 tons at the end of the month. *E. & M. J.'s* Weighted Index of Non-Metallic Mineral Prices declined fractionally as a result of a slight weakening in price of crude pottery-grade feldspar, though this decline was partly offset by a small increase in the price of Grade "A" calcined magnesite in California.

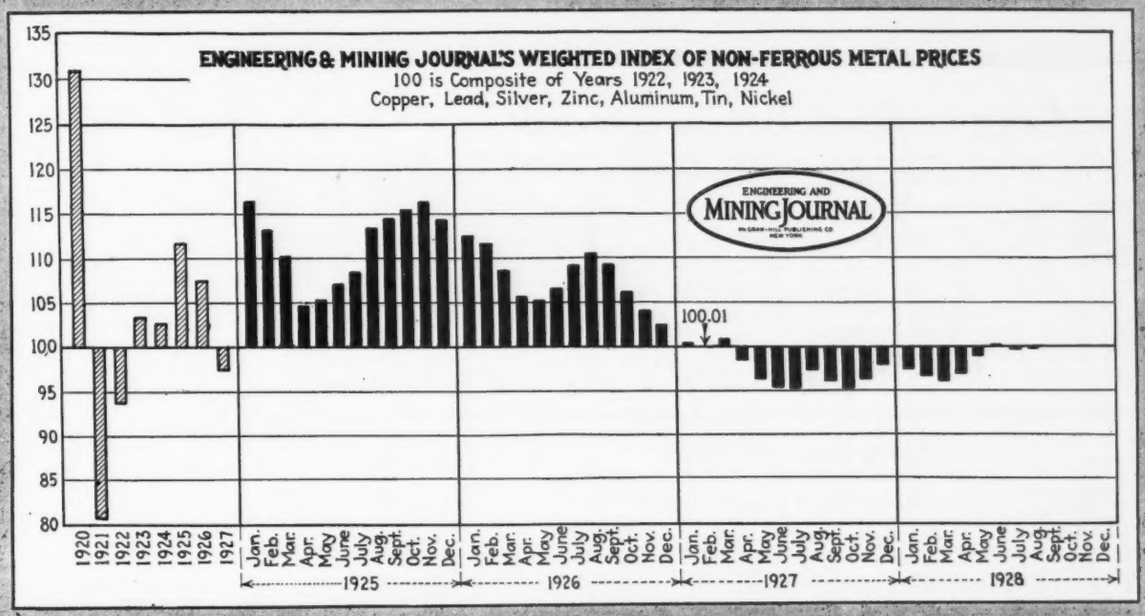
Current Statistics of Production and Stocks of Copper, Lead and Zinc

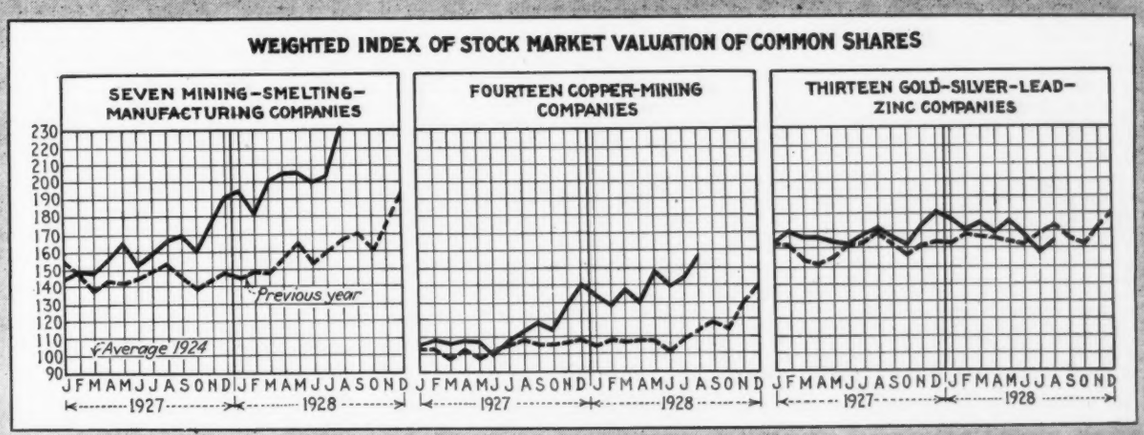
Data from American Bureau of Metal Statistics

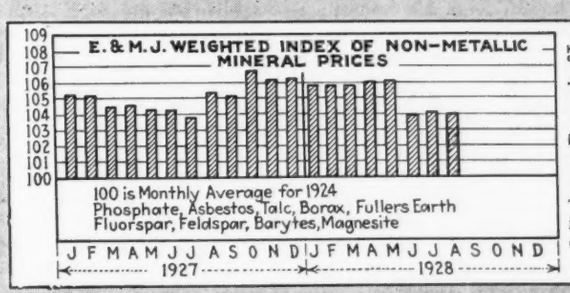
Figures Represent Short Tons

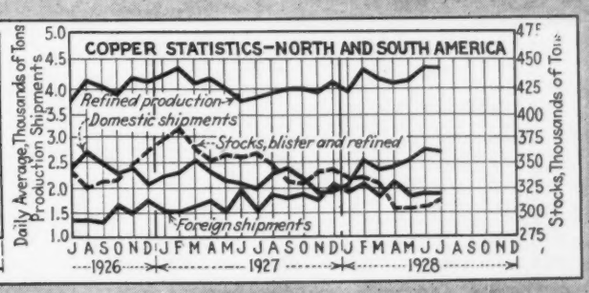
	1927		1928		
	Average	July	May	June	July
COPPER—North and South America					
Production, refined, daily average	4,045	3,811	4,169	4,367	4,358
Domestic shipments	68,737	61,965	79,103	81,436	82,245
Foreign shipments	53,489	48,140	56,738	57,067	56,785
Stocks, blister and refined	351,611	355,871	308,043	310,503	312,544
LEAD—United States and Mexico					
Production, smelter, daily average	2,513	2,510	2,345	2,470	2,219
Production, U. S. mines, daily average	1,798	1,581	1,661	1,717	1,568
Imports into U. S. A.	13,451	16,067	12,439	14,505	.....
Stocks, smelter and refinery	156,878	165,589	159,375	162,274	158,919
ZINC—United States					
Production, daily average	1,681	.....	1,723	1,694	1,642
Domestic deliveries	45,811	47,359	49,818	49,780	49,510
Exports, slab zinc	3,468	5,682	2,148	1,709	2,145
Exports, ores and dross	4,424	8,471	361	268	.....
Stocks	37,602	39,323	45,225	44,468	42,210
World Production Rate (Daily average)					
Copper	4,543	4,264	4,949	5,215	4,942
Lead	4,514	4,567	4,247	4,392	4,079
Zinc	3,910	3,748	4,112	4,131	4,010

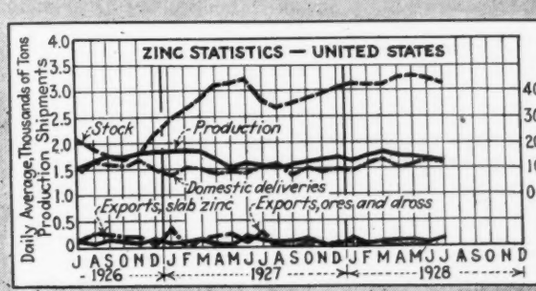
E.&M.J. Statistics of the Mining Industries

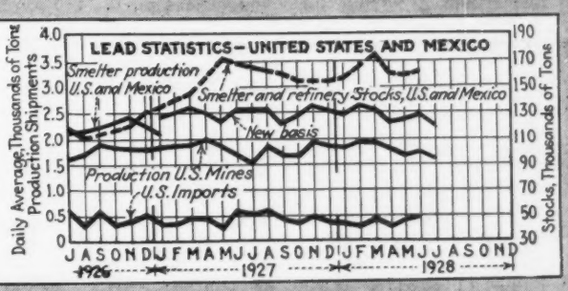





E. & M. J. WEIGHTED INDEX OF NON-METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate, Asbestos, Talc, Borax, Fullers Earth
Fluorspar, Feldspar, Barytes, Magnesite
1927
1928







The Market Report

Copper Sales Break Record

Lead Active, Zinc Quiet—No Change in Prices

New York, Sept. 12, 1928.—Sales of copper during the week ending today are the largest in the four years during which *E. & M. J.* has kept detailed data, and a new record is established by a considerable margin. Price continues unchanged at 14.75c. per pound delivered, Connecticut Valley basis. The activity in copper has been the outstanding feature of the week's business, though an average volume of lead changed hands with prices virtually unchanged. Tin, following a midweek downward sag in prices, is somewhat stronger again today and closes the week without appreciable net change in price. Zinc buying has been almost negligible though no tendency toward lower prices is observed. Silver was quiet but prices rose slightly during the week. Quicksilver and antimony prices are somewhat firmer; cadmium, arsenic, and the platinum metals continue unchanged.

Daily Prices of Metals

Sept.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
6	14.50@14.55	47.375	6.40	6.25	6.25
7	14.525@14.55	47.00	6.40	6.25	6.25
8	14.50@14.525	47.00	6.40	6.225@6.25	6.25
10	14.50@14.55	47.00	6.40	6.25	6.25
11	14.50@14.55	47.00	6.40	6.225@6.25	6.25
12	14.525	47.50	6.40	6.25	6.25
	14.525	47.146	6.400	6.246	6.250

Average prices for calendar week ending Sept. 8, 1928, are: Copper, 14.525; Straits tin, 47.338; N. Y. lead, 6.400; St. Louis lead, 6.245; zinc, 6.250; and silver, 57.900.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis: that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
6	62 13/16	63 5/16	68 1/2	211 1/4	209 1/4	22 3/16	21 7/8	24 13/16	24 7/8
7	62 13/16	63 5/16	68 3/4	210 3/4	209 1/8	21 15/16	21 11/16	24 5/8	24 11/16
10	62 13/16	63 5/16	68 1/2	209 7/8	208 1/4	22 1/8	21 13/16	24 11/16	24 13/16
11	62 3/4	63 1/4	68 3/4	209 5/8	208 1/4	22 1/4	22	24 3/4	24 13/16
12	62 13/16	63 5/16	68 1/2	210 1/8	209 1/2	22 1/8	21 13/16	24 11/16	24 13/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
6	4.84 3/4	57 3/8	26 9/16	84s11 1/4d	10	4.84 11/16	57 7/8	26 11/16	84s11 1/2d
7	4.84 3/4	57 3/8	26 1/2	84s11 1/4d	11	4.84 11/16	57 3/4	26 9/16	84s11d
8	4.84 3/4	57 3/8	26 9/16	.....	12	4.84 11/16	57 5/8	26 1/2	84s11 1/2d
						Avg.	57.729		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pense per troy ounce of sterling silver, 925 fine. Sterling quoations represent the demand market in the forenoon. Cables command one-quarter cent premium.

Tremendous Business in Copper

Following the activity of the preceding week, a decline in volume of copper buying for the current week was expected by some authorities. However, it appears that when the copper buyers decide to buy copper they do no halfway job of it. Sales for the current week more than doubled the total reported last week, which was approximately twice as large as the average week. Leading interests among the brass and cable manufacturers have been responsible for a considerable portion of the business, though most consuming interests find representation among the buyers. An unusually large number of sales has been reported for delivery in the Middle West and in the immediate vicinity of refineries. October has been the month specified for delivery on most of the sales. September shipment has been in demand, in several instances, though but little prompt metal can be had. A small amount of copper for November delivery was negotiated for, and in a very few instances December delivery was agreed upon. Probability of an advance in price is said to rest largely on the behavior of buyers in the next few days. If their demand for copper continues at anything like the present rate, advances in price will probably be the result. Export sales are in average volume. Copper Exporters, Inc., maintain their price at 15c. per pound, c.i.f. usual European destinations.

Lead Active and Firm

With the volume of sales well up to the average and some sellers out of the market for near-by delivery, the position of lead at the moment seems strong. Prices are virtually unchanged, the only development being the disappearance of some metal to be had in the St. Louis market at 6.225c. It is doubtful if any seller today would be willing to shade 6.25c., the figure at which the leading interest has been firm all week. The American Smelting & Refining Company continues its contract price in New York at 6.40c. and that price has ruled for all other business, including the Smelting company's own current sales. One important seller, who incidentally is oversold for September, reports inquiry for October comparatively small thus far; on the other hand some producers have done a good business for October and some sales have been made for November delivery. Statistics just released by the A.B.M.S. show total stocks of lead in the United States and Mexico on Aug. 1, to be 158,919 tons, a decline of nearly 5,000 tons during July, and the lowest supply reported since Feb. 1. The decline is largely accounted for by the smaller intake at U. S.

smelters, as smelters in Mexico received somewhat more lead than in June. London has fluctuated within narrow limits with virtually no net change for the week.

Dull Week in Zinc

Sales of zinc in the domestic market have been almost non-existent during the last week, which has been one of the dullest weeks during the year on a basis of tonnage. Recent statistical releases have shown a tendency toward a somewhat higher rate of production in the Tri-State district and this condition may be serving to keep buyers out of the market. All business reported during the week has been on the basis of 6.25c. per pound, East St. Louis.

The August statistics of the American Zinc Institute follow, figures being in tons of 2,000 lb.:

Stock, Aug. 1	42,210
Produced	52,157
	94,367
Shipped	49,951
Stock, Aug. 31	44,416

These figures indicate a surplus of production over shipments for August amounting to 2,206 tons; whereas in July a deficit of production under shipments amounting to 2,258 tons was recorded.

Spot Tin at 47½c.

The phenomenal appetite of the tinplate industry in the United States, coupled with good demand from the automobile manufacturers has prevented a further slump in the price of tin for the present. Deliveries of foreign tin in the United States were 7,200 tons in August, the highest month for more than a year. The sustained demand on the part of consumers has tended to offset the effect of large increases in the supply. Yesterday saw a good volume of buying and today the market is still more active with the price marked up to 47.50c. for spot. Some Chinese tin, 99 per cent grade, is in the market, bringing ¾c. to 1c. under the price for Straits. Selling of spot metal by one of the large London firms has had the effect of narrowing the premium for spot Straits over forward to about ¾c.

Silver Market Featureless

The market continues quiet and featureless and quotations have fluctuated within narrow limits. Reports from abroad state that China and India both bought and sold but the volume of business done seemed to have little effect on prices.

Correction—London silver quotation for Aug. 29 was given as 26d. in our issue of Sept. 1, through error. The correct quotation is 26⅞d. The correct figure was used in compiling the monthly average, however.

Mexican Dollars (Old Mexican Pesos): Sept. 6th and 7th, 43⅜c.; 8th, 43¼c.; 10th, 44c.; 11th, 43⅞c.; 12th, 43¾c.

Foreign Exchanges Easier

Sterling has suffered a small net decline during the week ending today, and the other important foreign exchanges are a little easier. Closing cable quotations on Tuesday, Sept. 11, were as follows: francs, 3.90½c.; lire, 5.23⅝c.; and marks, 23.825c. Canadian dollars, ⅛ per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York; Chinese brands, for all positions 10¾c. Cookson's "C" grade, spot, 15¾c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM—Per lb., New York: 70@80c., according to quantity.

IRIDIUM — Per oz., $285@$300 for 98@99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $42@$44. Small lots bring up to $50. Market very dull.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $74@$74.50 bid, $75@$76 asked. Nominal.

QUICKSILVER — Per 76-lb. flask, $128. Small lots command a slight premium. Market firm. San Francisco wires $127.67.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Sept. 8.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn; 35@38c. Caucasian, washed, 53@55 per cent. 38@40c. Chemical grades unchanged from quotations in the Sept. 8 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.; Wolframite, $10.90@$11, Western scheelite, $11@$11.25.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the Sept. 8 issue.

Tri-State Miners Reducing Output

Joplin, Mo., Sept. 8, 1928

Blende	Per Ton
High	$42.95
Premium blende, basis 60 per cent zinc	$40.00@41.00
Prime Western, basis 60 per cent zinc	40.00
Fines and slimes, 60 per cent zinc	36.00@39.00
Average settling price, all zinc	40.32
Galena	
High	85.20
Basis 80 per cent lead	82.50
Average settling price, all lead	81.99

Shipments for the week: Blende, 8,858; lead, 2,570 tons. Value, all ores the week, $567,910.

The owners of the larger producing mines will not continue to increase their stocks of zinc concentrates, and are shutting down some properties. Almost 1,000 tons was the decrease this week, and another 1,000 tons reduction is promised for next week. Zinc ore producers are following the lead made by the smelters to limit the production of their commodity to the evident demand.

The high price reported paid for lead concentrates and the good average settling price suggests that some sellers may have received as they claim, a premium price higher than the buyers' quotation of $82.50 basis.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Sept. 8 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Sept. 8 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $33 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 96@98c. f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrovanadium, Monel Metal, Nickel Silver and Yellow (Muntz) Metal are unchanged from prices in the Sept. 8 issue.

Rolled Metals

Copper, Lead, and Zinc Sheets are unchanged from prices in the Sept. 8 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Sept. 8.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces. Bessemer, $17@$17.50, basic, $16@$16.50; No. 2 foundry, $16.75@$17.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.85@1.90c.

Coke—Per gross ton, Connellsville furnace, contract, $2.75@$3; spot, $2.50@$2.75. Connellsville foundry, contract, $3.50@$4.85; spot, $4@$4.85. By-product coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended Sept. 8, 1928

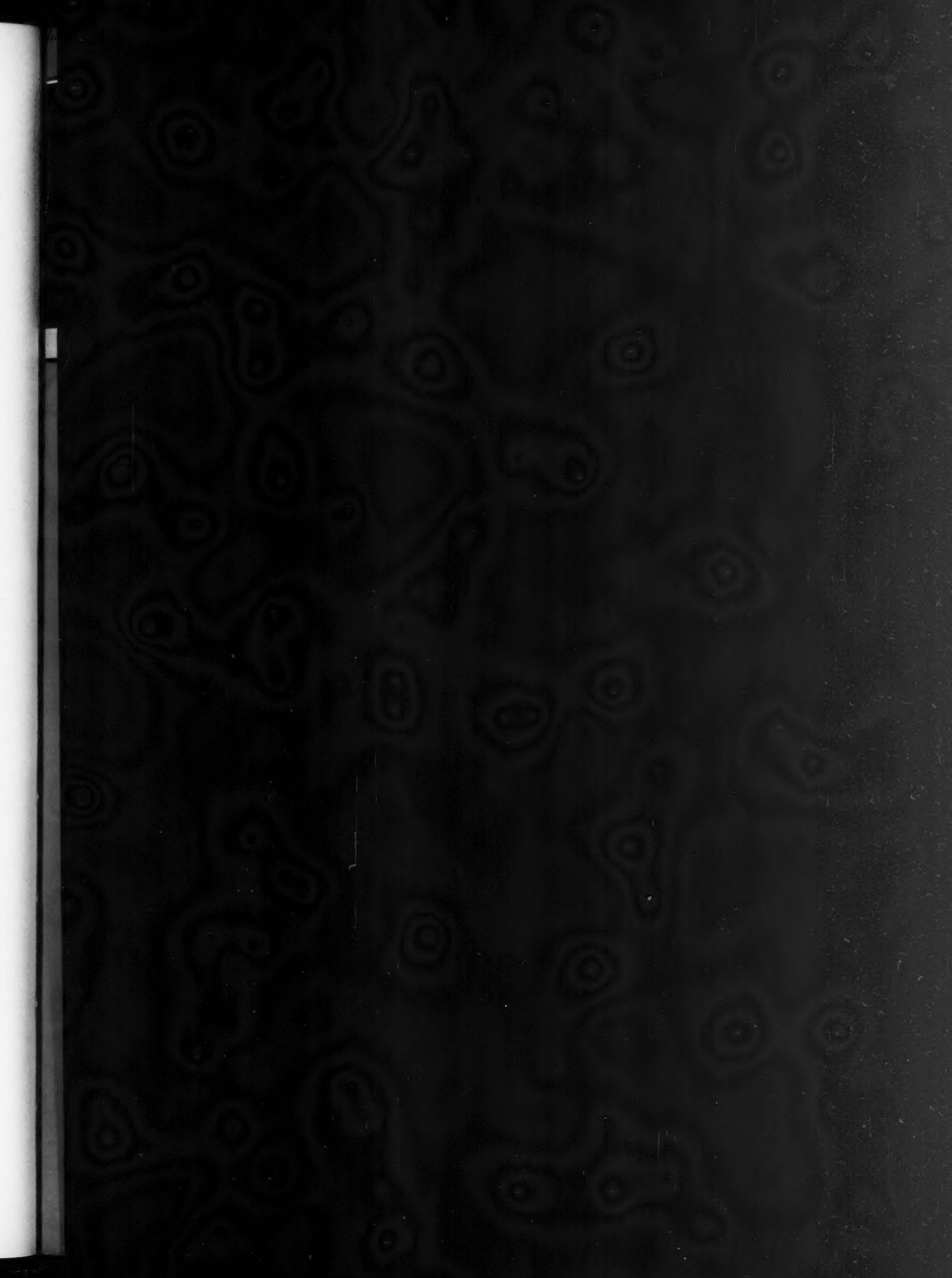
Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	76⅛	74	74⅛	Jl.14, Au. 20 Q	1.00
Ariz. Com'l	Boston	5⅛	5	5⅛	Jl. 16, Jl. 31 SA	0.25
Cal. & Ariz.	New York	106⅛	102	102⅛	Se. 7, Se. 24 Q	1.50
Calumet & Hecla	Boston	33½	29½	32	Au. 31, Se. 15 Q	0.50
Cerro de Pasco	New York	82½	79½	79½	Jl.12, Au. 1 Q	1.25
Chile Copper	New York	51½	47⅛	48	Se.15 Se.29 Q	0.62½
Con. Coppermines	N. Y. Curb	12⅛	11⅛	11⅛		
Copper Range	Boston	21⅛	20½	20½	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*36	*33	*35		
East Butte	Boston	3	2½	2⅝	Dec., 1919	0.50
Granby Consol	New York	60½	58½	58⅝	Jl.13, Au.1 Q	1.00
Greene Cananea	New York	122⅛	114⅛	117	Se. 14, Oc.1 Q	1.00
Howe Sound	New York	61	58½	59⅝	Je.30, Jl. 16, Q	1.00
Inspiration Consol	New York	25⅝	23½	25½	Apr. 1927 Q	0.25
Isle Royale	Boston	23½	20½	21	Au.31, Se.15SAX	0.75
Kennecott	New York	100½	97½	97½	Au.31, Oc 1 Q	1.50
Magma Copper	New York	61	55½	61	Jl.29, Jl.16 Q	0.75
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Miami Copper	New York	22	21⅛	21⅞	Au.1, Au.15, Q	0.37½
Mohawk	Boston	59	56½	57	Jl. 31, Se. 1 Q	1.00
Montana-Idaho	Spokane	*12	*10	*11½		
Mother Lode Coal	New York	2⅛	2⅛	2⅛	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	26⅛	25⅛	26	Se.14, Se.29 Q	0.37½
New Cornelia	Boston	29⅞	29	29⅛	Au.3, Au. 20 Q	0.50
Noranda	N. Y. Curb	56⅛	52½	53½		
North Butte	Boston	5	4⅛	4⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*74	*65	*68	Sept., 1926	0.03
Old Dominion	Boston	18⅛	16	16½	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	150	145	150	Je.25, Jl.22 Q	2.00
Quincy	Boston	46	40½	42⅛	March, 1920	1.00
St. Mary's Min. Ld.	Boston	31⅛	30	30	Ap.1928 A	2.00
Seneca Copper	New York	3⅛	2⅞	3		
Shattuck-Denn	N. Y. Curb	17⅛	16½	16½		
Tenn. C. & C.	New York	15	14⅛	14⅛	Au., 31 Se.15,Q	0.25
United Verde Ex	N. Y. Curb	14⅛	13⅛	14⅛	July 6, Q	0.50
Utah Copper	New York			170	Se.14, Se.29 Q	2.00
Utah Metal & T	Boston	1 1/16	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	1.32½	1.25	1.30		
NICKEL-COPPER						
Internat. Nickel	New York	125½	115⅛	124	Se.10, Se.29 Q	0.75
Internat. Nickel pfd.	New York	111⅛	110	111⅛	Jl.12, Au.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*4	*3½	*3½	June, 1927	0.005
National Lead	New York	125½	124	125½	Se.14, Se.29 Q	1.25
National Lead, pfd. A	New York			142½	Au.31, Se.15 Q	1.75
National Lead, pfd. B	New York			121	Oc. 19, No.1 Q	1.50
St. Joseph Lead	New York	48⅛	44⅛	46⅛	Je.9, Je.20, QX	0.75
ZINC						
Am. Z. L. & S.	New York	34½	30⅛	31	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	93½	90½	90½	Nov., 1920	1.50
Butte C. & Z.	New York	9⅛	8	9⅛	De., 1926	0.50
Butte & Superior	New York	10⅛	10	10⅛	Se.14, Se.29 Q	0.50
Callahan Zn-Ld	New York	3	2½	2½	De., 1920	0.50
Consol. Lead&Zinc 'A'	St. Louis	13	13	13	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	19⅛	18⅛	18⅛	No.15, De.1 Q	0.40
Eagle-Picher pfd.	Cincinnati			100	July 15 Q	1.50
New Jersey Zn.	N. Y. Curb	221	215	220	Jl. 20, Au. 10 X	2.00
Treadwell-Yukon	Toronto	18.00	16.00	16.00		
United Zinc	N. Y. Curb	*60	*60	*60		
Yellow Pine	Los Angeles			*25	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	5⅛	3⅛	4⅛		
Ankerite	Toronto	*25	*25	*25		
Barry-Hollinger	Toronto	*59	*49	*57		
Central Manitoba	Toronto	1.00	*98	1.00		
Cresson Consol. G.	N. Y. Curb	*89	*80	*89	Je.30, Jl.10 Q	0.10
Dome Mines	New York	10⅛	8⅛	10	Je.30, Jl.20 Q	0.25
Gold Hill	Toronto	*13½	*11½	*12		
Golden Cycle	Colo.Springs	†1.65	†1.64		My. 31, Je.10 Q	0.04
Hollinger Consol	Toronto	9.00	8.60	8.60	Au.22, Se.15 FW	0.10
Homestake Mining	New York	75½	75	75½	Se.2, Se. 20 M	0.50
Kirkland Lake	Toronto	1.60	1.50	1.59		
Lake Shore	Toronto	23.25	22.50	22.50	Se.1, Se.15, QX	0.20
McIntyre Porcupine	New York	23⅛	23⅛	23⅛	Au.1, Se.1 Q	0.25
Portland	Colo.Springs	†*20	†*18⅛		Ap., 1927	0.02
Rand Mines	New York			39½	Au.21-28 Am.Sh	1.52
Sylvanite	Toronto	3.10	2.45	3.00		
Teck-Hughes	Toronto	9.30	9.00	9.10	Jl. 17, Au. 1 SAX	0.15
Tom Reed	Los Angeles	*60	*56⅛	*56⅛	Dec., 1926	0.02
Tough-Oakes	Toronto	*38⅛	*27	*36⅛		
Vipond Cons	Toronto	*65	*50½	*54	April, 1927	0.03
Wright-Hargreaves	Toronto	3.50	3.30	3.32	Jl.16, Au.1 Q	0.02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	21	17⅛	20⅛		
Con. Cortez	N. Y. Curb			*22		
Dolores Esperanza	N. Y. Curb	1⅛	*90	1.00	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb			15	Jl.18, Jl.28 Q	0.50
Premier Gold	N. Y. Curb			2⅛	Je.14, Jl.3 Q	0.06
Tonopah Belmont	N. Y. Curb			*90	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*11	*11	*11	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	4 1/16	4 1/16	4 1/16	Mar.31, Ap.21 SA	0.07½
West End Consol	N. Y. Curb			*4	Mar., 1923	0.05
Yukon Gold	Boston Curb	*66	*60	*60	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	*88	*88	*88	May, 1920	0.03
Castle-Trethewey	Toronto	*45	*40	*41		
Coniagas	Toronto			4.50	May, 1924	0.12½
Keeley	Toronto	*43	*40	*40	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto			*50	July, 1925	0.05
Mining Corp. Can.	Toronto	3.50	3.26	3.40	My.20, Je.13 SA	0.125
Nipissing	N. Y. Curb	3⅛	3⅛	3⅛	Je.30, Jl.20½	0.075

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅞	3½	3½	Ap., 1927	0.12½
Bingham Mines	Boston	49½	48½	48½	Jl.31, Au.4 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	125½	125	125	Au.31, Se.4 MX	0.75
Cardiff M. & M.	Salt Lake	*56	*53	*53	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	3.60	3.50	3.55	Ja.10, Fe.1 K	0.10
Consti'n Mng.&Mill'g.	Spokane	*25	*15	*25		
Erupcion	Boston Curb	*20	*20	*20	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	1.75	1.70	1.75		
Federal M. & S.	New York	135	135	135	Je., 1927	10.00
Federal M. & S. pfd.	New York			100	Au. 24, Se. 15 Q	1.75
Golconda	Spokane	*93	*91	*92		
Hecla Mining	N. Y. Curb	15	15	15	Au.15, Se. 1 Q	0.15
Highland-Surprise	Spokane	*10⅛	*9	*10½		
Iron King Mining	Salt Lake	*81	*80	*80		
Keystone Mining	Salt Lake	*30	*20	*20	Fe., 1926	0.07½
Lucky Jim	Spokane	*27½	*26½	*27		
Lucky Tiger-Com.	Kansas City	†6.87½	†6.62½		Se. 6, Se. 20	0.05
Mammoth Mining	Salt Lake	1.40	1.35	1.35	De., 1926	0.25
North Lily	Salt Lake	7.95	7.75	7.95		
Park Utah	New York	11	10½	10⅝	Se., 11, Oc.1 Q	0.20
Plutus Mining	Salt Lake	1.75	1.55	1.55	Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	*44	*42	*42	June 15 Q	0.03
Sherman Lead	Spokane	*24	*22½	*23		
Silver King Coal	Salt Lake	13⅛	13½	13½	Se.20, Oc.1 Q	0.25
Silversmith	Spokane	*9	*7½	*8⅛	Oct., 1926 Q	0.02
Strattons Mines	Spokane	1.32	1.25	1.30		
Sunshine M. Co.	Spokane	1.42	1.37½	1.40	June 20, K	0.02
Tamarack-Custer	Spokane	*44	*40	*41	Sept., 1924	0.25
Tintic Standard	Salt Lake	14½	14	14	Je.18, Je.30 QX	0.30
Utah-Apex	Boston	4⅛	3⅞	4	Jl.14, Au.1 K	0.25
IRON						
Bethlehem Steel	New York	64½	61½	63½	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	130	120	122	Jl.14, Jl.25. Q	1.00
Colorado F & I, pfd.	New York	67⅞	64⅝	65	Au.10, Au.25 Q	2.00
Gt. North'n Iron Ore	New York	23½	21½	22⅝	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	68⅛	66⅛	68⅛	Au. 15, Se. 1 Q	0.62½
Republic I. & S.	New York	72⅝	65⅛	71⅛	Au. 14, Se. 1 Q	1.00
Republic I. & S. pfd.	New York	107	104	107	Se. 15, Oc. 1 Q	1.75
Sloss-Sheffield S. & I.	New York	121⅛	113	121⅛	Se.10, Se.20 Q	1.50
Sloss-Snef. S.&I. pfd.	New York	111⅛	111⅛	111⅛	Se. 20, Oc. 1 Q	1.75
U. S. Steel	New York	158⅜	152	155⅞	Au.30, Se.29 Q	1.75
U. S. Steel, pfd.	New York	141⅛	141	141	Au. 6, Au. 30 Q	1.75
Virginia I. C. & C.	New York			27	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York			50	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York			26	Ju.16, Ju.26 K	0.97
So. Am. G. & P.	N. Y. Curb	4⅛	4	4		
Alum. Co. of Amer.	N. Y. Curb	142	139⅛	140		
Alum. Co. of Amer. pf.	N. Y. Curb	108	107	108	Je. 15, Jl. 1 Q	1.50
Vanadium Corp.	New York	84	76⅛	81⅛	Au. 1, Au. 15 Q	0.75
Patino M. & E.	New York	36⅞	33⅛	33⅛	April, 1928	4s.
ASBESTOS						
Asbestos Corp.	Montreal	28⅛	27⅛	28⅛	Jan., 1926	1.50
Asbestos Corp. pfd.	Montreal	90	89	90	Jl. 30, Jl. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	63⅞	61	62⅛	Jl.14, Au.1 QX	1.75
Texas Gulf	New York	74	71⅛	72	Se. 1, Se 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	49⅞	47⅛	47	Au. 21, Se 1 Q	0.75
Amer. Metal, pfd. 6%	New York	113	111	113	Au.15, Se.1 Q	1.50
Amer. Met. pfd. 7%	New York			125	My.15, Je.1	1.75
Amer. Sm. & Ref.	New York	249⅛	240	245½	Jl 13, Au.1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	137	136	137	Au. 3, Se. 1 Q	1.75
Consol. M. & S.	Montreal	260	258	259	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	170⅛	164⅛	166½	Je.30, Jl.16 Q	1.00
U. S. Sm. R. & M.	New York	50⅛	49½	49⅛	Jl. 5, Jl. 14 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	54½	53½	54⅛	Jl. 5, Jl 14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED August 28, 1928

Name	High	Low	Last	Date	Last Div. Amount
Alaska Mexican ($5)	35/—	25/—	30/—		
Alaska Treadwell ($25)	120/6	120/—	120/—	Nov., 1926	4 (d)
Aramayo Mines (25 frs.)	63/9	60/—	62/6	May, 1928	5 p.c. (†)
Burma Corpn. (10 rupees)	14/7½	13/10½	14/3	Aug., 1928	6 annas*
Bwana M'Kubwa (5s)	8/3	7/—	8 —		
Camp Bird (2s)	3/6	3/3	3/6	April, 1928	16⅜ p.c.
El Oro (£1)	4/—	3/9	4/—	Nov., 1924	2½ p.c.*
Frontino & Bolivia (£1)	11/10½	11/9	11/9	July 1928	3½ p.c.
Mexican Corpn. (£1)	10/—	9/7½	9/9		
Mexico Mines of El Oro (£1)	20/—	15/10½	17/6	Dec., 1926	3½ p.c.*
Mond Nickel	91/3	84/—	91/3	Aug., 1928	20 p.c.
N'Changa Copper Mining	19/10½	19/9	19/9		
Oroville Dredging (£1)	3/9	3/3	3/9	Dec., 1923	3½ p.c.
Rhodesian Congo Border (£1)	32/6	30/—	30/—		
St. John del Rey (£1)	11/9	10/10½	11/3	April, 1928	7½ p.c.
San Francisco Mines (10s)	29/—	28/1½	28/7½	July 1928	12½ p.c.
Santa Gertrudis (£1)	15/—	14/6	14/9	July 1928	7½ p.c.
Selukwe (2s. 6d.)	10/—	9/9	9/6	April, 1917	6¼ p.c.
S. Amer. Copper (2s.)	2/3	2/1½	2/1½	Nov., 1917	75 p.c.
Tanganyika (£1)	65/—	58/6	63/1½	July 1928	5 p.c.
Union Miniere de Haut-Katanga (Brussels)	11,740	10,850	11,741	July, 1928	182.60 (‡)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.